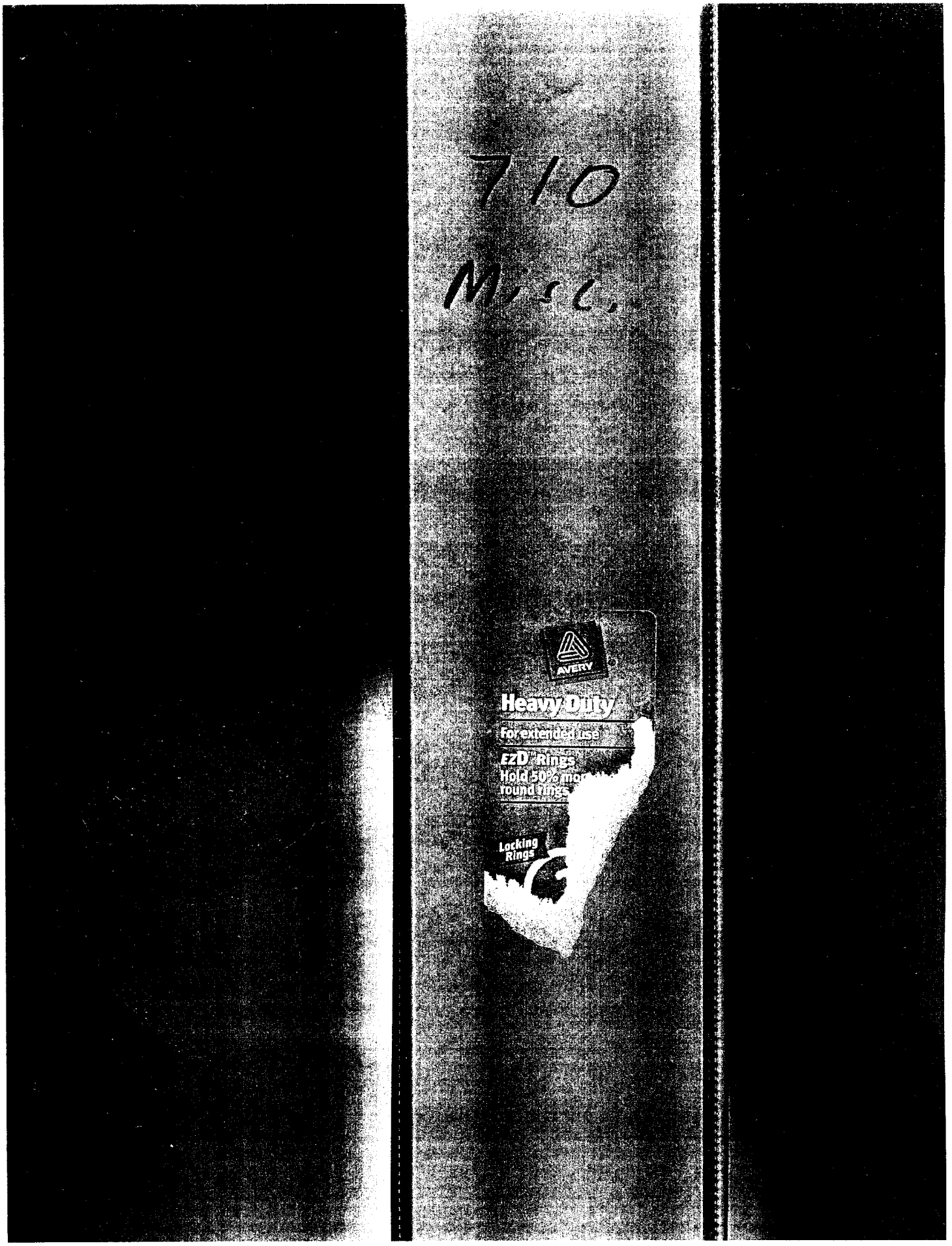

710
M.S.C.
AVERY
Heavy Duty
For extended use
EZD Rings
Locking Rings

MF1239

Remington

710 Assembly Report

Trigger Housing:

After familiarizing myself with the housing assembly I made a few observations. A fixture to hold the housing is a must. Chuck made a prototype fixture which works pretty well for assembling the housing. Also, I recommend that we only use rubber hammers on these housings, the slots that the set screws go into might break and the threads of the screws might be damaged if we use metal hammers. I noticed another problem having to do with the trigger hanging up in some of the housings we built. After tearing them down we noticed a few possible causes...First, the pin that holds the trigger in seems to be short as it does not go entirely through the housing. Second, the top set screw does not seem to be hitting inside of the hole in the trigger connector. Third and finally, the housing may be warped or made incorrectly.

Total average for build.....2 min. 8 sec.
597 housing assembly comparision.....5 min 46 sec.

Without knowing how long it takes to set the engagement its hard to set a time for an estimate of daily build.

Tools needed:

1. Bench w/light , parts bins, tool suspension frame and balancer	1774.35	3548.70
2. Adjustable Chair	239.25	478.50
3. Fixture to build housing on		
4. Brading fixture		
5. Rubber Hammer	14.49	28.98
6. 1/8 flat screwdriver	1.65	3.30

Bolt Assembly:

This was very hard to get a time on because almost every part of the assembly needs some kind of fixture to assist you with putting it together. The time does not include gauging the extractor which Shelley says is done on the model 700.

Total average for build.....3 min. 24 sec. compared to 2 min. 26 sec. for 597

Again, hard to set a estimate on how many we could build in a day.

Tools needed:
1. Fixture to hold bolt head to allow you to install retaining pin while holding ejector .
2. Fixture to install extractor ring
3. Fixture to compree firing pin spring enabling you to screw rear of firing pin assembly on.
4. 1/8 punch
5. 1/16 punch

6. 12 oz. ball pein hammer	10.99	21.98
7. Bench w/light and accessories	1774.35	3548.70
8. Adjustable Chair	239.25	478.50

Final Build:

I have a lot of questions about this part of the gun. Will all the stock screws use the same bit? If we put the sights on at least stage, will we need 2 air powered screwdrivers or will we change bits? 83 Are we supposed to check for free float? Shelley said something about a null safety check that was done on the model 700, are we going to check for it on the 710? Is this the best place to check for the critical ejection port fit that Mike talked about?
We used no air tools when bulding this gun up so the time will drop considerably when we can use all our powered tools.

Total average build time.....4 min. 43 sec. compared to 2 min. 5 sec. for 597 gun build and 2 min. 39 sec. for barrel assembly

Estimated daily production per builder.....84 guns

Tools needed:

1. Bench w/light and accessories	1774.35	3548.70
2. Adjustable Chair	239.25	478.50
3. 12 oz. ball pein hammer	10.99	21.98
4. 12 oz. rubber hammer	14.49	28.98
5. 1/8 flat screwdriver	1.65	3.30
6. T-handle tap holder	26.90	53.80
7. Air powered screwdriver	420.00	840.00
8. Cordless screwdriver	95.95	191.90

Gallery:

If you look on the time sheet you'll see I timedthis two different ways. I think the timed rack of 30 is probably more accurate because it takes into account all that goes on in the testing area...from getting the guns from the builders all the way through to bringing them out to pack.

Total average build time.....1 min. 49 sec. compared to 2 min. 55 sec. for 597 Magnum.
Total time for rack of 30.....1 hour.

Tools needed:
I have no additions to Jamie's list of tools.

Packaging:

I did pack exactly the same way I timed gallery by the gun and by a rack of 30.
Lois and Debbie as well as others complained that the bolt wa too hard to close and open, is this just because of the prototype or is this normal? They also complained that the length of the gun made it hard to clean. They suggested getting lower tables for this gun.

Total average build time.....2 min. 50 sec.
Total time for rack of 30.....1 hour 55 min. 3 sec. (2 hours)

Tools needed:
Jamie's list is complete unless we move pack for this gun closer to the new gallery if so we need...

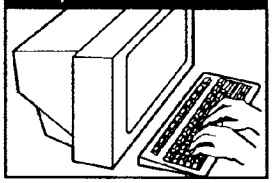
1. Bench w/light	**1774.35**	**3548.70**
2. 12 oz ball pein hammer	**10.99**	**21.98**
3. Computer and printer		
4. Stapler air powered	**360.25**	
5. Tape dispenser	**6.52**	**13.04**
6. Scissors		
7. Flashlight		
8. Cleaning rod		
9. 1/8 screwdriver	**1.65**	**3.30**
10. tag attacher?		
11. swivel tool		
12. allen tool		

AVERY®

Feed this end into printer
Avery **BIG TAB** Inserts for Dividers - 8 Tab

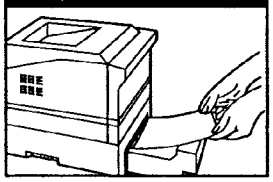
Printing your inserts is easy!

Step 1 - Format



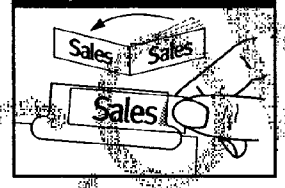
Key in your insert titles using the **preset layouts** in your existing word processing software.

Step 2 - Print



Use your laser or ink jet printer to print titles onto insert sheets.

Step 3 - Insert



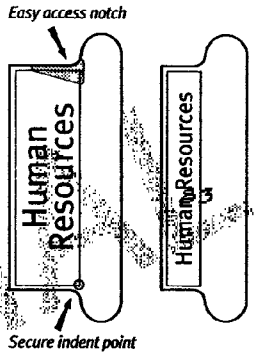
Fold inserts in half and slide into **BIG TAB**. Side-by-side printing allows tab to be read from both sides.

Turn over for complete formatting instructions

Patent Pending

BIG TABS are better!

- **Use larger size fonts** or print more lines of text on big inserts.
- **Keep inserts from falling** out of tab with secure indent point.
- **Slide in or remove inserts easily** with easy-access notch.



BIG TAB Standard

Technical Support

Avery Dennison offers **FREE** technical support bulletins to assist you in formatting and printing Avery Tab Inserts. Call our Technical Support, and we willl send a bulletin to you.

Avery Dennison Technical Support:
972-389-3699

We're here to help
To find out more about our complete line of products and software solutions, contact our Consumer Service Center:

1-800-GO-AVERY
(1-800-462-8379)

www.avery.com

 RM 1003

AVERY®
Feed this end into printer
Avery BIG TAB Inserts for Dividers - 8 Tab

MF1243

AVERY®

Feed this end into printer

Avery **BIG TAB** Inserts for Dividers - 8 Tab

Microsoft® Word
for Windows
Versions 6.0, 7.0 and Word97

Follow step-by-step:

1. Click on **Tools** menu, then click on **Envelopes and Labels.**
2. Click on **Labels** tab, then click on **Options** button
3. Under **Product number** List
   - Click on ***Worksaver 8-Tabs***
   - Set tray to **Manual Feed** if available
   - For Word97 - Click **New Label**
     For Word 6.0/7.0 - Click the **Details** button
4. Make the following changes:

Top margin	0.5"
Side margin	2.75"
Vertical pitch	0.5"
Horizontal pitch	3.5"
Label height	0.5"
Label width	1.5"
Number across	2
Number down	20
Page size (Word97)	Letter

   - For Word97 – Enter **Label name:** Type *"Big Tabs8"* and click **OK**
   - For Word 6.0/7.0 - Click **OK** to the custom label message.
   - For all versions - Click **OK** (again), then click **New Document.**
5. To Center and Enter Text:
   - Hold down **Ctrl + A** keys to highlight
   - Hold down **Ctrl + E** keys to center
   - Click in top left insert to type text
   - Press the **Tab** key to move to the next insert

IMPORTANT: Type the same text side-by-side to create insert that can be read from both sides of the tab

- Press the **Tab** key to repeat and complete the insert titles

SEE PRINTING INSTRUCTIONS

WordPerfect®
for Windows
Version 6.0, 6.1, 7.0, or 8.0

Follow step-by-step:

1. For WordPerfect 6.1/7.0/8.0 - Click on **Format** menu. For WordPerfect 6.0 - Click on **Layout** menu
2. Choose **Labels.**
   - Select label file: wp_wp_us.lab
   - For WordPerfect 6.0/6.1 - Click on **WI-213-8 WorkSaver** ***(Front)***
   - For Word Perfect 7.0/8.0 – Click on **Avery WorkSaver 8-Tab**
   - Click **Create.**
3. In the **Label Description** box,
   - Type *"Avery Big Tabs 8"*
   - In the **Label Type** box, select **Laser.**
4. Make the following changes:

Label Size:	Height	0.5"
Labels Per Page:	Rows	20
Top Left Label:	Left Edge	2.75"
Distance Between Labels:	Columns	0.0

   - Click **OK**, then click **Select** button in the Labels dialog box
5. To Center and Enter Text:
   - Click on the **Format** menu, select **Justification**, then **Center**
   - Click on the **Format** Menu. Select **Page**, then **Center**
   - Select **Current and subsequent pages**, then click **OK**
   - Begin typing text in the first insert
   - Press **Ctrl + Enter** keys to move to the next insert

IMPORTANT: Type the same text side-by-side to create insert that can be read from both sides of the tab

- Press **Ctrl + Enter** keys to repeat and complete insert titles

SEE PRINTING INSTRUCTIONS

All other word processors

Follow these general formatting instructions. Adjust as needed:

1. Set the **Page Margins** as follows:

Left:	**2.75"**	Top:	**0.5"**
Right:	**2.75"**	Bottom:	**0.5"**

2. Set two center-aligned tabs
   - If software offsets tabs from left margin (e.g. Microsoft Works®)
     Tab 1: **0.75"** Tab 2 **2.25"**
   - If software offsets tabs from left edge of paper (e.g. Lotus Ampro®):
     Tab 1: **3.5"** Tab 2 **5.0"**
3. Set **line spacing** or **line height** to **0.5"**
   Note: Select inches (in.) or include inch marks (") if necessary.
4. To Enter Text:
   - Press **Tab** key to move to first insert and type text
   - Press **Tab** key to move to next insert **IMPORTANT: type same text side-by-side to create inserts that can be read from both sides of the tab**
   - Press the **Return** key to move to next line. Press **Tab** key to repeat and complete the insert titles

SEE PRINTING INSTRUCTIONS

Printing instructions

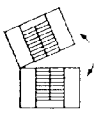
Follow step-by-step:

1. Insert a sheet of **plain paper** in Manual Feed Tray.
2. Set printer to "Manual Feed" if necessary. **Print a test sheet.**
3. Hold printed test sheet against insert sheet to **check alignment.**
4. Load the **insert sheet** and print using your printer's manual feed tray.

PRINT A HALF-SHEET. Save the rest for later.

NOTE: Only for printers capable of feeding 8 1/2" x 5 1/2" paper sizes.

1. Split insert sheet in half - horizontally



2. Feed into printer on non-perforated side (see arrows on top and bottom of insert sheet)

Need assistance? Check your printer manual or contact Avery Dennison Technical Support.
TURN OVER FOR CONTACT INFORMATION

AVERY®

Feed this end into printer

Avery **BIG TAB** Inserts for Dividers - 8 Tab

710 NEW PRODUCT PROPOSAL

NEW PRODUCT PROPOSAL

PRODUCT DESCRIPTION: **Sportsman Model 710 Bolt Action Rifle**

This proposal is to develop a low cost, high margin, centerfire bolt action rifle targeted at the economy price market. Development of the Model 710 should be based on:

- Reduced Cost Of Manufacture
- Reduced Manufacturing Lead Time
- Ease Of Use
- Low Development Cost
- Low Capital Investment
- Above Average Gross Profit (45%)

The Model 710 should provide the following features:

- Short, Long And Magnum Calibers
- Standard Barrel Lengths (22" & 24")
- Synthetic And Wood Stock Versions
- Floor Plate Or Magazine Box (Lowest Cost)
- Reasonable Bolt Action Trigger
- Scope Base Mounting Capability
- Optional Iron Sights
- Low Cost Metal Finish
- right And Left Hand Configurations

Along with the standard configurations, scope combo packages will also be offered. These would include mounting and bore sighting a low cost 3-9 power scope on the rifle.

MARKET OVERVIEW:

Remington is currently the market share leader in the centerfire bolt action market. However, this position has been threatened as a result of aggressive competitive pricing, expanding competitive offerings and a saturation of high-end niche markets.

Significant volume in this market has migrated to the economy segment where Savage and USRAC have carved a niche and gained share. Remington is not positioned with the Model 700 family to compete effectively in this segment which is controlled by the mass merchants. A new introduction in the form of the Sportsman Model 710 will provide the opportunity for Remington to capture a share of this emerging market segment while maintaining a significant presence in the high-end segment with the Model 700.

Np89.doc jrb 9/23/97

PROPOSED TIMING: 2000 Catalog

VOLUME:

Year 1	Year 2	Year 3
40,000	50,000	55,000

Replacement volume detail: 15,000 Replacement of the current M/700 ADL Syn

PRICING:

MSP: $229 Target Std. Gross Profit: 45%

NSP: $188 Target Cost: $103

PROJECT RESPONSIBILITY: E-Town - D. Diaz

PREPARED BY: _____ APPROVED BY: _____

Np89.doc jrb 9/23/97

WHITE PAPER – COSTING REFERENCE

83

MF1248

REMINGTON ARMS COMPANY, INC.
FIREARMS - MAYFIELD 12/10/99

C:\windows\TEMP\[Book2.xls]m710 58,300 597 30,000 710

PART DESCRIPTION	Part #	710 Costing Model 58,300 597s & 30,000 710s Material $	Run Rate (hrs/pc)	Labor $	Fixed O.H. $	Var O.H. $	Total O.H. $	Total
Document Envelope Assembly	1721	$ 0.09		$ -	$ -	$ -	$ -	$ 0.09
Document Envelope	1649	0.08		-	-	-	-	0.08
Users manual	3391	0.15		-	-	-	-	0.15
Product Owners Card	1426	0.03		-	-	-	-	0.03
Remington Authorized Gunsmith	3413	0.07		-	-	-	-	0.07
Safety Booklet	3499	0.10		-	-	-	-	0.10
Oval Label	3491	0.01		-	-	-	-	0.01
Carton Assembly	1444	2.05		-	-	-	-	2.05
Box and Envelope Label (710)	993002	0.04		-	-	-	-	0.04
Shelf Talker		0.14		-	-	-	-	0.14
Barrel Assembly Complete	305410		*0.0790*	0.71	1.08	2.06	3.14	3.85
Barrel Assembly	3305400			-	-	-	-	-
Barrel	305315	4.80	0.3866	4.09	6.25	11.90	18.15	27.04
Receiver	300340	1.76	0.0055	0.06	0.09	0.17	0.26	2.08
Receiver Insert Assembly Complete	????		*0.0530*	0.47	0.73	1.38	2.11	2.58
Receiver Insert Assembly	????		*0.0050*	0.04	0.07	0.13	0.20	0.24
Receiver Insert	300327	0.62		-	-	-	-	0.62
Threaded Insert	300347	0.04		-	-	-	-	0.04
Side Plate	300333	0.09	0.0010	0.01	0.02	0.03	0.05	0.15
Side Plate Pin (2)	300328	0.16	0.0010	0.01	0.02	0.03	0.05	0.22
Sear Safety Cam	15666	0.94		-	-	-	-	0.94
Pivot Pin (3)	300351	0.27		-	-	-	-	0.27
Sear Spring	17047	0.05		-	-	-	-	0.05
Trigger	15280	1.53		-	-	-	-	1.53
Trigger Connector	19461	1.03		-	-	-	-	1.03
Trigger Screw Front	17053	0.07		-	-	-	-	0.07
Trigger Engagement Screw	91128	0.06		-	-	-	-	0.06
Trigger Spring	15400	0.05		-	-	-	-	0.05
Trigger Stop Screw	15481	0.04		-	-	-	-	0.04
Safety	300408	0.23		-	-	-	-	0.23
Safety Detent Spring	300407	0.06		-	-	-	-	0.06
Safety Pivot Pin	300352	0.14		-	-	-	-	0.14
Safety Spring	300343	0.05		-	-	-	-	0.05
Safety Button		0.41	0.0050	0.05	0.08	0.15	0.23	0.70
Safety Plunger		0.07		-	-	-	-	0.07
Safety Key/Cap/Bushing		0.69		-	-	-	-	0.69
Bolt Stop	300345	0.22	0.0010	0.01	0.02	0.03	0.05	0.28
Receiver Plug Screws (4)	17034	0.12		-	-	-	-	0.12
Recoil Bracket	300361	0.19	0.0010	0.01	0.02	0.03	0.05	0.25
Bolt Assembly Complete	????			-	-	-	-	-
Bolt Body Assembly	????		0.0275	0.29	0.45	0.85	1.29	1.59
Bolt Body	300339	0.74	0.0032	0.03	0.05	0.10	0.15	0.92
Bolt Handle	300370		0.0120	0.13	0.19	0.37	0.56	0.69
Bolt Handle Blank	300360	1.63		-	-	-	-	1.63
Bolt Handle Pin	300329	0.10		-	-	-	-	0.10
Bolt Head Assembly	305390		*0.0580*	0.52	0.79	1.51	2.30	2.82
Bolt Head	300338	1.75	0.0809	0.86	1.31	2.49	3.80	6.40

REMINGTON ARMS COMPANY, INC.
FIREARMS - MAYFIELD

12/10/99

C:\windows\TEMP\[Book2.xls]m710 58,300 597 30,000 710

		710 Costing Model 58,300 597s & 30,000 710s						
PART DESCRIPTION	Part #	Material $	Run Rate (hrs/pc)	Labor $	Fixed O.H. $	Var O.H. $	Total O.H. $	Total
Extractor	93712	0.77		-	-	-	-	0.77
Ejector	300342	0.11	0.0010	0.01	0.02	0.03	0.05	0.17
Ejector Spring	????	0.02		-	-	-	-	0.02
Ejector Pin	94555	0.04		-	-	-	-	0.04
Bolt Assembly Pin	300330	0.15	0.0010	0.01	0.02	0.03	0.05	0.21
Firing Pin Assembly	????		*0.0070*	0.06	0.10	0.18	0.28	0.34
Bolt Plug	300368	0.25		-	-	-	-	0.25
Bolt Plug Insert	300346	0.80		-	-	-	-	0.80
Firing Pin	300334	1.19	0.0010	0.01	0.02	0.03	0.05	1.25
Firing Pin Tip	300335	0.33	0.0015	0.02	0.02	0.05	0.07	0.42
Firing Pin Head	300336	1.50	0.0020	0.02	0.03	0.06	0.09	1.62
Firing Pin Spring	????	0.10		-	-	-	-	0.10
Front Sight	94084	0.82		-	-	-	-	0.82
Front Sight Ramp	94657	1.13	0.0020	0.02	0.03	0.06	0.09	1.25
Front Sight Ramp Screws (2)	28505	0.09		-	-	-	-	0.09
Rear Sight Assembly	103146			-	-	-	-	-
Elevation Screw	90906	0.04		-	-	-	-	0.04
Rear Sight Aperture	94333	0.14	0.0030	0.03	0.05	0.09	0.14	0.31
Rear Sight Base	103531	0.97	0.0030	0.03	0.05	0.09	0.14	1.14
Rear Sight Slide	94335	0.47	0.0050	0.05	0.08	0.15	0.23	0.76
Windage Screw	90904	0.02		-	-	-	-	0.02
Rear Sight Base Screw (2)	28505	0.09		-	-	-	-	0.09
Stock Assembly Complete	**????**		*0.0160*	0.14	0.22	0.42	0.64	0.78
Stock Assembly	????			-	-	-	-	-
Stock	????	5.38		-	-	-	-	5.38
Front Screw Bushing	15161	0.13		-	-	-	-	0.13
Middle Screw Bushing	????	0.05		-	-	-	-	0.05
Rear Screw Bushing	????	0.05		-	-	-	-	0.05
Grip Cap	97971	0.18		-	-	-	-	0.18
Recoil Pad	97973	1.63		-	-	-	-	1.63
Recoil Pad Screw (2)	98008	0.02		-	-	-	-	0.02
Magazine Latch	300362	0.19		-	-	-	-	0.19
Magazine Latch Spring	????	0.03		-	-	-	-	0.03
Magazine Latch Pin	300371	0.07	0.0010	0.01	0.02	0.03	0.05	0.13
Sling Swivel Stud (2)	300096	0.14		-	-	-	-	0.14
Takedown Screw (2)	**????**	0.16		-	-	-	-	0.16
Rear Takedown Screw	**????**	0.08		-	-	-	-	0.08
Magazine Assembly	**????**		*0.0083*	0.07	0.11	0.22	0.33	0.40
Magazine Box	300363	2.90	0.0010	0.01	0.01	0.03	0.04	2.95
Magazine Follower	300364	0.26		-	-	-	-	0.26
Magazine Bottom	300365	0.26		-	-	-	-	0.26
Magazine Spring	17028	0.42		-	-	-	-	0.42
Freight on Parts		0.25						0.25
Value Added Cost of: Proof/Gallery/Inspect/Pack		1.15	*0.1500*	1.34	2.05	3.91	5.96	8.45
Total Cost		**$ 43.05**	**0.9226**	**$ 9.15**	**$ 13.98**	**$ 26.61**	**$ 40.59**	**$ 92.79**

REMINGTON ARMS COMPANY, INC.
FIREARMS - MAYFIELD 12/10/99

C:\windows\TEMP\[Book2.xls]710 capital by operation

In House Capital

Part Name	Operation	Equipment	Capital Required			Useful Lif	Depreciation
Barrel	Cut off		$0				
	Drill	cones	$9,960	Dec-99		10	996
	Ream		$0			10	-
	Rifle	gages	$9,800	Feb-00		10	980
	Wash & Stress Relieve	baskets	$6,900	Feb-00		10	690
	Turn	gages	$10,100	Feb-00		10	1,010
	Face & Chamber	gages	$33,300	Apr-00		10	3,330
	Face & Chamber	machine	**$222,880**	Mar-00		10	22,288
	Cut off and Crown	chuck	$15,000	Jan-00		10	1,500
	wash and eddy current test	machine	$75,000	Mar-00		10	7,500
	Induction Harden	machine	**$166,000**	Mar-00		10	16,600
	Inspect Hardness	machine	$12,000	Mar-00		10	1,200
	Drill and tap sight	fix & gages	$7,600	Feb-00		10	760
	Roll mark	fix & gages	$6,300	Apr-00		10	630
	Angularity Straighten	fix & gages	$3,500	Feb-00		10	350
	Centerless Polish		$0			10	
	Glass Bead Blast	fixtures	$2,500	Jan-00		10	250
	Color	racks	$6,000	Jan-00		10	600
Bolt Head	Inspect Purchased Part Blank	gage	$2,500	Feb-00		10	250
	Superabrasive Grind Lugs	fix & gage	$43,800	Feb-00		10	4,380
	CNC Machine Bolt Face Complete	fix & gage	**$174,784**	Mar-00		10	17,478
	CNC Machine Cam Cuts - Ejector Retaining Pin Hole	fix & gage	$15,000	Mar-00		10	1,500
	CNC Machine Bolt Head Retaining Pin Hole	fix & gage	$15,000	Mar-00		10	1,500
	Punch Form Extractor Rotation Notch	fix & gage	$10,000	Jan-00		10	1,000
	Vendor Heat Treat		$0			10	-
	Inspect for Hardness		$0			10	-
	Black Oxide		$0			10	-
Bolt Body	Inspect Purchased Part Blank	gage	$2,000	Jan-00		10	200
	Machine Cam Cuts	machine	$0	Feb-00		10	-
	Assemble Braze Bolt	machine	$90,000	Mar-00		10	9,000
	Deplate	tanks	$9,500	Jan-00		10	950
	Eddy Current Test		$0			10	-
	Glass Bead Blast	fix	$2,500	Jan-00		10	250
	Black Oxide		$0			10	-
Receiver	Inspect Purchased Part Blank	gage	$2,500	Jan-00		10	250
	Machine A-load	machine & CM	**$513,831**	Feb-00		10	51,383
	Machine B-load		$0	Feb-00		10	-
	Vibratory tumble deburr		$0			10	-
Barrel Assembly	Press Receiver to Barrel	fixture	$0	Dec-99	Ilion Equip	10	-

REMINGTON ARMS COMPANY, INC.
FIREARMS - MAYFIELD 12/10/99

C:\windows\TEMP\[Book2.xls]710 capital by operation

	Inspect for straightness	gage	$3,500	Dec-99		10	350
Final Assembly	Gallery	100yd range	**$100,000**	Dec-99		25	4,000
		snails	$30,000	Jul-00		25	1,200
		HVAC	$25,000	Jun-00		10	2,500
		other	$10,000	Mar-00		25	400
						25	-
			$100,000	Mar-00		25	4,000
			$65,000	Jul-00		25	2,600
			$1,801,755				

Purchased Parts

Part #	Part Name	Capital	Tool	Vendor			Payments	
300327	Receiver Insert	48,000	Mold	Hanson	Jun-99	5	9,600	
300333	Side Plate	*10,000*	Stamping Die		Dec-99	5	2,000	Mar-00 Apr-00
300334	Safety Arm	23,880	Stamping Die	NH Stamping	Dec-99	5	4,776	Mar-00 Apr-00
300345	Bolt Stop	6,820	PM	Sterling	Dec-99	5	1,364	Mar-00 Apr-00
300361	Recoil Bracket	2,225	Stamping Die	NH Stamping	Dec-99	5	445	Mar-00 Apr-00
300360	Bolt Handle Blank	12,800	Invest Cast Die	Fansteel	Dec-99	5	2,560	Mar-00 Apr-00
300366	Bolt H. Braze Shim	*0*	Use Paste	Lucas Milhaupt	Dec-99	5	-	Mar-00 Apr-00
300368	Bolt Plug	38,088	Mold	Par 4	Dec-99	5	7,618	Mar-00 Apr-00
300336	Firing pin head	23,000	MIM Mold	Megamet	Dec-99	5	4,600	Mar-00 Apr-00
300362	Mag Latch	33,480	Mold	Par 4	Dec-99	5	6,696	Mar-00 Apr-00
300363	Magazine Box	*28,000*	Mold	Morrisey	Dec-99	5	5,600	Mar-00 Apr-00
300364	Magazine Follower	33,300	Mold	Par 4	Dec-99	5	6,660	Mar-00 Apr-00
300365	Magazine Bottom	47,880	Mold	Par 4	Dec-99	5	9,576	Mar-00 Apr-00
	Stock	**150,300**	Mold	Par 4	Dec-99	5	30,060	Mar-00 Apr-00
	Styrofoam Bed	0	Die	Tuscorora		5	-	Mar-00
	PPI	38000						
		$495,773						
	Total	**$2,297,528**					253,430	
	Installation	$61,000				10	6,100	
		$2,358,528					259,530	

REMINGTON ARMS COMPANY, INC.
FIREARMS - MAYFIELD

12/10/99

C:\windows\TEMP\[Book2 xls]Start Up Costs

	8/31/99	9/30/99	10/31/99	11/30/99	12/31/99	Total 1999	1/31/00	2/29/00	3/31/00	4/30/00	5/31/00	6/30/00	7/31/00	Total 2000	Project Total
Direct Labor			3,188.64	4,555.20	3,871.92	11,615.76			7,109.76	8,809.92	10,200.96	6,800.64		32,921.28	44,537.04
From Overhead						-								-	-
Setters			-	-	-	-	3,625.60	8,565.48	5,349.80	1,767.76		3,070.32	3,535.52	25,914.48	25,914.48
Maintenance			-	-	-	-	2,582.40	5,084.10	5,717.34	4,198.24	3,148.68	4,253.48	2,099.12	27,083.36	27,083.36
EBs			1,849.41	2,642.02	2,245.71	6,737.14	3,600.64	7,916.76	10,542.60	8,570.03	7,742.79	8,192.18	3,268.09	49,833.09	56,570.23
Other Costs						-								-	-
Travel	124.93		10,000.00			10,124.93								-	10,124.93
Material for Receiver		2,175.00				2,175.00								-	2,175.00
Material for Bolt Body			3,000.00			3,000.00								-	3,000.00
Material for 1,000 Learning Guns ($43.86/ea)						-			21,930.00	21,930.00				43,860.00	43,860.00
Material for 60 T&P Guns ($43.86/ea)						-				1,315.80	1,315.80			2,631.60	2,631.60
Material for 30 DAT Guns ($43.86/ea)						-						1,315.80		1,315.80	1,315.80
15,000 rns of Ammo						-			600.00	1,200.00	600.00	600.00		3,000.00	3,000.00
Disassembly & Rearrange						-			6,000.00					6,000.00	6,000.00
Tooling & Inspection		15,265.47	16,250.00	16,250.00	16,250.00	64,015.47								-	64,015.47
Prototype Parts						-	8,000.00	8,000.00	8,000.00	8,000.00				32,000.00	32,000.00
Material Handling Purchases						-					19,333.33	19,333.33	19,333.33	58,000.00	58,000.00
Miscellaneous		5,496.16	9,803.56	9,803.57	9,803.56	34,906.85	286	286	286	286	286	286	286	2,000.00	36,906.85
1999 startup Costs	124.93	22,936.63	44,091.61	33,250.78	32,171.19	132,575.15	18,094.35	29,852.05	65,535.22	56,077.47	42,627.28	43,851.46	28,521.78	284,559.61	417,134.76

BUSS BAR LOADS

OBJECTIVE - TO SEE IF THE BUSS BARS HAVE ENOUGH CAPACITY LEFT FOR THE NEW MACHINES NEEDED FOR THE MODEL 710.

BUSS RATING - 800 A

 # OF BUSS - 2 (NORTH, SOUTH)

NORTH BUSS

MACHINE	FUSED @
CHILLER (REAMER)	10 A
CHILLER (DRILL)	20 A
RIFLER	45 A
REAMER	60 A
REAMER	60A
GUNDRILL	125 A
GREENARD PRESS	20 A
LIGHTING PANEL	200 A
DUAL HEAD DRILL	10 A
OKUMA (RAIL)	40 A
O-12	10 A
ROLLMARK 575	20 A
RECEIVER	40 A
RECEIVER	40 A
CARBON BOLT	40 A
TUNGSTEN	40 A
TUNGSTEN	40 A
DADSON	40 A
OKUMA (B.A.)	40 A
OKUMA (B.A.)	40 A
MONARCH	80 A
MONARCH	80 A
CROWN	40 A
CHAMBER	40 A
TORIT (POLISHER)	10 A
ROLLMARK (B.A.)	10 A
SURFACE GRINDER	25 A
0-18	10 A
TOTAL	**1235 A**
BUSS LOAD - (1235 A) (30%) = **LOAD**	**370.5 A**

46 % OF BUSS IS CURRENTLY BEING USED

SOUTH BUSS

MACHINE	FUSED @
ASSEMBLY PANEL	200 A
EDGETEK	100 A
CENTRIFUGE	40 A
SOUTHBEND LATHE	4 A
AMERICAN PACEMAKER LATHE	5 A
BRIDGEPORT	4 A
BRIDGEPORT	4 A
SURFACE GRINDER	15 A
ROTO FINISH	10 A
CITIZEN	30 A
SHIPPING PANEL	100 A
GUNDRILL	125 A
GRAYMILLS PARTS WASHER	30 A
A/C UNIT	70 A
A/C UNIT	90 A
A/C UNIT	60 A
WAGNER CUT-OFF	20 A
TOTAL	**907 A**
BUSS LOAD - (907 A) (30%) = LOAD	**272.1 A**

34 % OF BUSS CURRENTLY BEING USED

COST PER MONTH AT $.065 PER KWH

MACHINE	KWH AT FULL LOAD	COST AT FULL LOAD AT $.065 PER KWH	KWH AT NORMAL LOAD	COST AT NORMAL LOAD AT $.065 PER KWH
OKUMA LT15MY	14691.6	$954.95	4848.23	$315.13
OKUMA LB300MY	9180	$596.70	3029.4	$196.91
G&L CORDAX CMM D-8	734.4	$47.74	242.35	$15.75
OKUMA 4018	7623.07	$495.50	2515.61	$163.51
OKUMA 4018	7623.07	$495.50	2515.61	$163.51
HEAT TREAT	10164.09	$660.67	3354.15	$218.02
INDUCTION UNIT	8968.32	$582.94	2959.54	$192.37
CHILLER	2541.02	$165.17	838.54	$54.51
CHILLER	2541.02	$165.17	838.54	$54.51
EDDY CURRENT TESTER	INFORMATION NOT AVAILABLE AT THIS TIME			
TOTALS	64066.39	$4,164.34	21141.97	$1,374.22

SUMMARY OF ADDED ELECTRIC USE FOR 710 PROJECT

AVERAGE OF EXISTING KW USAGES 248400KW

ESTIMATED INCREASED USAGE PER MONTH 21142 KW

THIS YIELDS AN INCREASE OF APPROXIMATELY 8.5% MORE POWER THAN IS CURRENTLY BEING USED

83

POWER CONSUMPTION

	KILO-VOLT AMPS	AMPS
TOTAL POWER AVAILABLE	2500	3000
AVERAGE POWER CONSUMPTION TO DATE	764	919
TOTAL REMAINING POWER	1736	2081

COST SUMMARY

COST SUMMARY FOR PLANT PREPARATION AND
INSTALLATION OF NEW MACHINERY FOR MODEL 710

REMINGTON ARMS
22 RIFFLE TRAIL
HICKORY KY,42051
856-4200

COST SUMMARY TABLE OF CONTENTS

REASONS FOR CHOOSING OKUMA

1) OPERATOR, MAINTANANCE, AND PROGRAMING FAMILIARTY.
2) OKUMA COMES STANDARD WITH MORE OPTIONS AT LOWER COST.
3) FIRST NAME BASIS WITH SERVICE DEPARTMENT AND PARTS DEPARTMENT AT GOSIGER.
4) ALREADY STOCK MANY SPARE PARTS FOR OKUMA IN CRIB.
5) OKUMA IS VERTUALY MAINTENANCE FREE.
6) DOWN TIME IS AT A MINIMUM.

COST TO MOVE ONE OKUMA MX45

COST FOR RIGGERS AND THEIR EQUIPMENT FOR ONE HALF DAY	$476.00
COST FOR THE RENTAL OF A GENI BOOM FOR ONE DAY	$525.00
COST FOR THE RENTAL OF A SCISSOR LIFT FOR ONE DAY	$350.00*
COST FOR EMPLOYEE LABOR	TWO MEN (24 Hrs)
COST FOR MISC. ELECTRICAL AND PLUMBING SUPPLIES	$250.00
TOTAL	**$1601.00****

* COST N/A IF MOVE IS LESS THAN 30 FT.

** THREE POSSIBLE MACHINE MOVES TO DATE (COST X THREE)

RIGGERS AND EQUIPMENT COST FOR MODEL 710 PROJECT

MACHINE	CONTRACTED LABOR	FORK LIFT	SKATES	EMPLOYEE LABOR	SUBTOTAL
OKUMA LT15MY	$288.00	$140.00	$40.00	N/A	$468.00
OKUMA LB300	$288.00	$140.00	$40.00	N/A	$468.00
OKUMA CROWN-V	$288.00	$140.00	$40.00	N/A	$468.00
OKUMA CROWN-V	$288.00	$140.00	$40.00	N/A	$468.00
TACO BRAZE	N/A	N/A	N/A	TWO MEN 4 HOURS	N/A
CHILLER (TACO)	N/A	N/A	N/A	TWO MEN 4 HOURS	N/A
INDUCTION UNIT	N/A	N/A	N/A	TWO MEN 4 HOURS	N/A
CHILLER (INDUCT.)	N/A	N/A	N/A	TWO MEN 4 HOURS	N/A
G&L D-8 CMM	N/A	N/A	N/A	TWO MEN 4 HOURS	N/A
EDDY CURRENT TESTER	(INFORMATION NOT AVAILABLE AT THIS TIME)				N/A
[redacted]					
TOTAL COST	$1,152.00	$560.00	$160.00	TWO MEN 20 HOURS	$1,872.00

COST FOR MACHINE INSTALLATION

MACHINE	LT 15 MY	LB 300	CROWN-V	CROWN-V	TACO BRAZE	CHILLER	INDUC. UNIT	CHILLER	D-8 CMM
ELECTRICAL									
CONDUIT	$102.00	$102.00	$102.00	$102.00	$68.40	$68.40	$68.40	$68.40	$68.40
TRANSFORMER	$1,310.00	$720.00	$720.00	$720.00	N/A	N/A	N/A	N/A	N/A
DISCONECTS	$970.00	$315.00	$315.00	$315.00	$275.00	$435.00	$250.00	$435.00	$25.00
FUSES	$125.20	$48.00	$48.00	$48.00	$13.50	$30.75	$13.50	$30.75	N/A
WIRE	$297.00	$105.60	$105.60	$105.60	$63.84	$24.96	$24.96	$24.96	$24.96
FITTINGS	$250.00	$250.00	$250.00	$250.00	$175.00	$175.00	$175.00	$175.00	$175.00
PLUMBING									
PIPE	$134.40	$134.40	$134.40	$134.40	$134.40	N/A	N/A	N/A	$134.40
REGULATOR	$133.82	$133.82	$133.82	$133.82	$133.82	N/A	N/A	N/A	$133.82
VALVES	$45.00	$45.00	$45.00	$45.00	$45.00	N/A	N/A	N/A	$45.00
FITTINGS	$50.00	$50.00	$50.00	$50.00	$50.00	N/A	N/A	N/A	$50.00
EQUIPMENT									
GENI BOOM	$156.60	$156.60	$156.60	$156.60	$156.60	$156.60	$156.60	$156.60	$156.60
SCISSIOR LIFT	$77.80	$77.80	$77.80	$77.80	$77.80	$77.80	$77.80	$77.80	$77.80
SUB TOTAL	$3,651.82	$2,138.22	$2,138.22	$2,138.22	$1,193.36	$968.51	$766.26	$968.51	$890.98
							TOTAL COST		$13,963.12

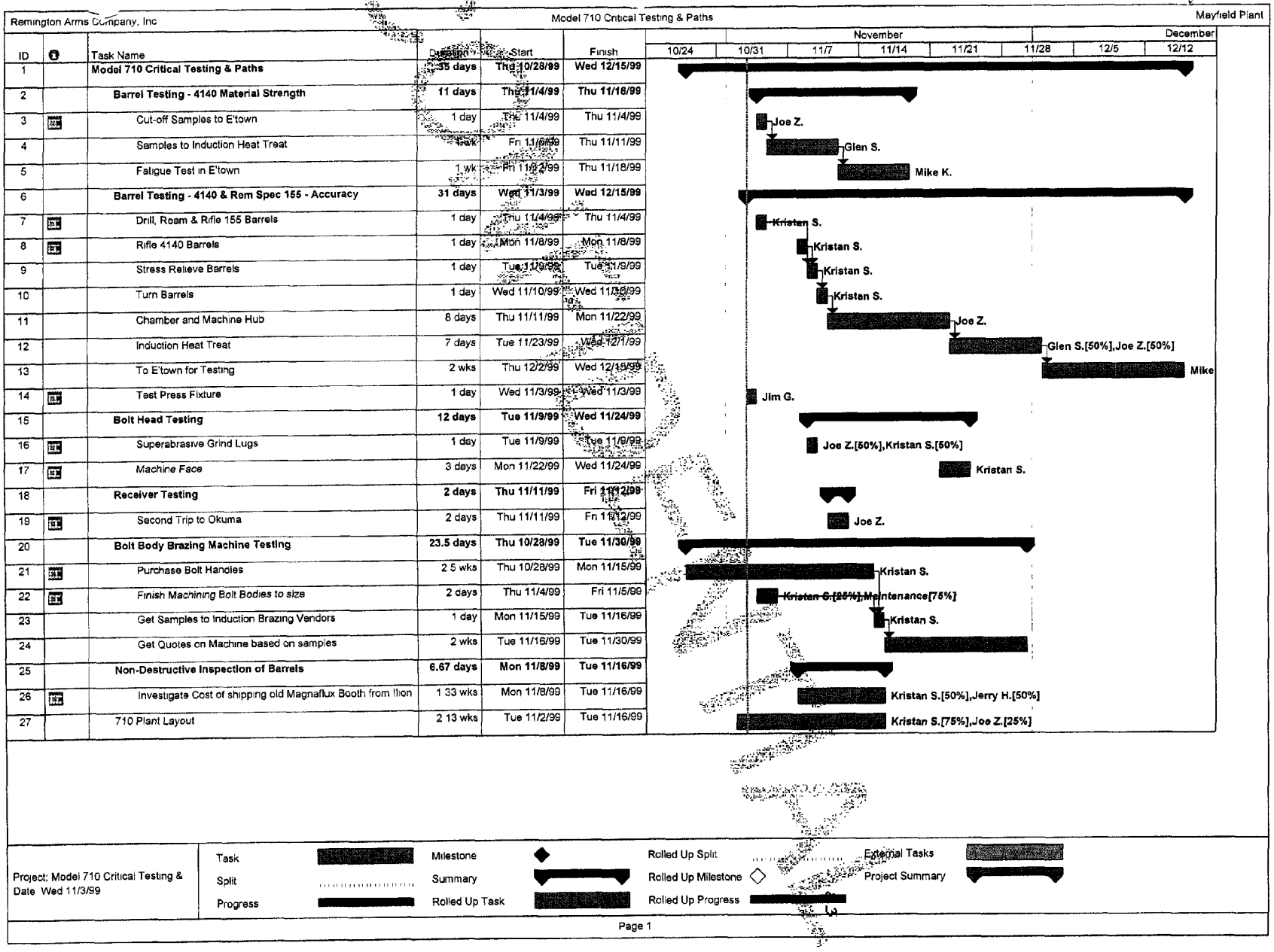
83

MATERIAL
HANDLING COSTS

83

710 TESTING
CRITICAL PATHS

MF1270



OKUMA
ENGINEERING
TRIALS REPORT

MF1272

Model 710 Engineering Trials Report

Summary

Engineering trials were conducted on three components of the Model 710 from October 11, 1999 to October 22, 1999 in order to gain more accurate information of tool lives, cycle time, and various other machining parameters. The machining tests were conducted in Charlotte, NC at the Okuma America Technology Institute, and utilized an Okuma LT-15M Turning Center. Technical assistance was provided by Okuma America and Matthew Machinery out of Louisville, KY.

The components machined on the LT-15 were:

- Model 710 Receiver, Part No. 300340
- Model 710 Bolt Body, Part No. 300339
- Model 710 Barrel, Part No. 305315

As a result of these machining tests important information was gathered on the best methods to manufacture these components and the cost associated with each. This information will be used to update and refine the Model 710 Project Estimate prior to final submission. Additionally, several opportunities to improve the manufacturability of the 710 design have been identified as a result of these machining trials. The results of the trials to date are given below.

Model 710 Receiver

There were numerous difficulties in machining the receiver. All features could be machined, although some were approximations of cuts and not to the model drawing specs, because the LT-15M available did not have a Y-axis option.

The problems encountered were:

- Boring the I.D. of the receiver due to vibration in the boring bar. This was due to the fact that the ratio of the depth of the receiver that needed to be bored vs. the boring bar diameter was excessively large. When that ratio exceeds 6:1 stock tooling begins to become ineffective at damping out vibration caused by cutting forces (the ratio for this operation is about 8:1). Exacerbating this situation was the fact that the tubing being machined was not to the O.D. & I.D. dimensions planned to be used in production. The closest stock size was used for these trials, but the closest stock material required removing app. 0.100 in. of material from the I.D. to get it to size. Several different methods were tried to overcome the chatter but without much success. Additional work needs to be done to determine the best options for creating the I.D. to model drawing dimensions and tolerances.
- Some difficulty in machining the various slots in the receiver body due to tool chatter. The tool chatter problem can be overcome by tooling changes.
- Chip evacuation was a problem. The low carbon steel w/ low hardness tends to produce long, stringy chips that are hard to break up and tend to tangle inside the receiver body. This can be overcome by more aggressive speeds & feed rates, but low carbon steel also tends to weld to cutting tool surfaces. Therefore, TiN, TiCN, or TiAlN coated tools are necessary to ensure long tool life. Indexable insert endmills may be an option for roughing cuts. The inserts tend to have good chip breaking abilities and are coated.

Model 710 Engineering Trials Report

Model 710 Receiver (cont'd)

Due to these difficulties it was not possible to run a substantial number of components. It was possible, though, to extrapolate the following information:

- **Machine cycle time:** 6 minutes actual vs. an estimated cycle time (100% efficiency) of 5.023 min.
- **Variable Tooling Cost:** $1.433 per part vs. an estimated cost of $0.927, due to having to purchase coated tools and reduced life for slotting endmills
- **Labor Run Rate:** .00417 (2 minutes of operator time required per one 8-piece (5 ft.)bar) vs. an estimated run-rate of .00397 (5 minutes of operator time per one 21-piece (12 ft.) bar)
- **Material Cost:** Remnant length app. 6" (same as original estimate). With a 5' long bar, this will result in 8 pcs per bar, and a per piece material cost of $2.178 vs. an estimated cost of $1.76. **NOTE:** The initial estimate did not calculate material cost based on DOM material, which will be necessary to use to help eliminate I.D. boring problem. Re-calculating the initial estimate material cost for a 12' bar with 6" remnant at the DOM price of $3.52 per foot yields a material cost of $2.028 per part, not $1.76

More detailed information is given in Appendix A.

The material used was plain low carbon tubing, 1.437" O.D. with a 0.25" thick wall. Since a bar feeder was not available, the tubing was cut into 32" lengths, which yielded 4 pcs per bar.

There is considerable opportunity to decrease tooling cost by testing indexable insert end mills for roughing the magazine well cut and ejection port cut. This tooling must be tested to see how it performs, though. If it works this style of end mill would replace one end mill completely, with an approximate savings of between $.30 and $.40 per part. Its effects on cycle time are not known as of yet.

The machine used for the receiver, the Okuma LT-15M, seems well suited for machining this component complete. The options required to maximize the machine's efficiency still require more research and more information from machining results. Some the problems encountered, like the formation of long stringy chips and whether the I.D. has to be bored out, will dictate what kind of bar feeder is purchased and how long the bar stock will be. As thing stand right now, if the I.D. has to be machined, then the bar stock length will be limited to about 5' max, and a magazine bar feeder will need to be utilized. Otherwise the chips formed by boring will become too compacted in a longer tube length and will interfere with machining. According to the bar feeder manufacturer normally used by Okuma, LNS, the smaller magazine bar feed system can be modified to provide through the spindle coolant or an air blast to clear chips out, but those options can't be put on a longer bar feeder.

Chips also present a potential problem for unloading the parts as well. LNS has a vacuum parts unloading system to literally suck the parts out through the back of the spindle, but an excessive amount of chips in the parts may interfere with the operation of the unloader. Okuma's parts catcher option for the LT-15 may end up being the better option for automatically unloading finished parts. The Okuma parts catcher will add approximately 7 seconds to any cycle time.

The material price changes above reflects the use of DOM (drawn over mandrel) seamless tubing with additional processing done to it to lower the O.D./I.D. concentricity to at or below 0.01. This concentricity would eliminate the I.D. boring operation and lower tooling cost. It may allow the use of the 12 foot bars again instead of shorter bars, resulting in a material cost of $2.028, or a reduction of app. $0.15 per part. The machine cycle time may not be substantially reduced, because the boring is done simultaneously with other operations on back end of the part. As a result the boring time is internal to the process. The concentricity is being reviewed with the tubing vendor to make sure the promised concentricity can be delivered.

Model 710 Engineering Trials Report

Model 710 Bolt Body

There were few problems encountered in machining the bolt body. All features could be machined. The only trouble encountered was with chips packing in the I.D. of the bolt body (same material as the receiver). This caused the insert on the boring bar to fail after approximately 80 pcs. Changing the grooving cycle can reduce chip size. Different types of inserts also need to be explored in order to optimize this tool. Overall, though, the machining went well. The same comments noted about the LT-15M machine and the automation needed for the receiver are equally applicable to the bolt body (i.e., bar stock length, unloading method, etc.). Cycle times, run-rates, etc. are given below:

- **Machine cycle time:** 1.933 minutes actual vs. an estimated cycle time (100% efficiency) of 1.959 min.
- **Variable Tooling Cost:** $0.285 per part vs. an estimated cost of $0.24, due primarily to decreased life in grooving insert
- **Labor Run Rate:** .00333 (2 minutes of operator time required per one 10-piece (5 ft.)bar) vs. an estimated run-rate of .00321 (5 minutes of operator time per one 26-piece (12 ft.) bar)
- **Material Cost:** Remnant length app. 4" (same as original estimate). With a 5' long bar, this will result in 10 pcs per bar, and a per piece material cost of $0.74 vs. an estimated cost of $0.74.

For more detailed information see Appendix A.

The material used was plain low carbon tubing, 0.75" O.D. with a .134" thick wall. Since a bar feeder was not available, the tubing was cut into 32" lengths, which yielded 5 pcs per bar.

Model 710 Barrel

There were few problems in machining the barrel chamber area. The features machined were the chamber, counterbore, bolt head clearance cuts and takedown screw holes. The machine available for use at Okuma did not have a Y-axis option; therefore the recoil lug slot could not be machined. It should be noted here that the machine desired to run the barrel chamber operation is an LB-300 MY lathe. The LT-15M was used to simulate this machine, as Okuma did not have an LB-300 available for use.

The primary difficulty encountered was machining the Ø.925 X .325 wide undercut. The tooling initially chosen, a grooving boring bar, ended up being too marginal to be used. The bar tended to rub in the counterbore when cutting to full depth. Several modifications to the boring bar head were tried; enough clearance was added for the bar to clear the counterbore, but it made the head too weak and it would break after 5 or so pcs. As a result a 5/16 HS cobalt T-slot cutter was used to cut the undercut groove. This change resulted in an additional minute being added to the cycle time. More research into different boring bars is needed in order to find a standard bar that will suit this operation. None have been found to date.

There was some chatter encountered initially in the cutting of the bolt head relief cuts (the "ears"). Feeds & speeds were modified to eliminate this problem; this resulted in the addition of app. 30 seconds to the cycle time. Different tooling choices will help in speeding up this operation.

The 4140 barrel material used in this runoff is not heat treated at this point in the barrel process, unlike a M/700 barrel. Therefore the steel adhered more readily to cutting tools. As a result of this the tool lives for the rough and finish reamers were reduced to ensure the chamber finish remained good enough. This will make sure there aren't any secondary chamber burnishing operations required.

Model 710 Engineering Trials Report

Model 710 Barrel (cont'd)

As previously stated above, the slot could not be cut in the barrel. Based on the experience gained from these trials, it is estimated that the recoil lug slot will add approximately 20 seconds (.33 min) to the cycle time. Load/unload time was approximately 10 seconds (.1667 min.). The cycle times, etc. are given below:

- **Machine cycle time (including estimate of Recoil Lug Slot & load/unload):** 5.57 minutes actual vs. an estimated cycle time (100% efficiency) of 3.69 min. , due primarily to the use of the T-cutter and slowing down the bolt head relief cut
- **Variable Tooling Cost:** $3.039 per part vs. an estimated cost of $2.762, due primarily to decreased life in the rough and finish reamers
- **Labor Run Rate:** .0928 vs. an estimated run-rate of .06146
- **Material Cost:** Not applicable for this operation

For more detailed information see Appendix A.

Conclusions

As a result of these trials, the following conclusions could be formulated:

- The total labor run-rate for the Model 710 project increased by .06 from the original estimate. This does not match the total increase list here (the total increase reported up to this point amounts to an increase of .317). In the process of running barrels up to the point where they were ready for the trials other information on cycle times were gathered. This resulted in no change in run rates for the barrel gundrill, ream, and rifle operations, and an increase of app. .03 to the turn operation. An additional turning pass was added to the turning operation.

- The total variable tooling cost increased by a total of $0.72 from the original estimate. This does not match the total increase list here (the total increase reported up to this point amounts to an increase of $0.829). In the process of running barrels up to the point where they were ready for the trials other information on tool lives and cycle times were gathered. This resulted in a tooling cost reduction of $0.109 for the barrel gundrill, ream, rifle, and turn operations.

- The total material cost for the Model 710 project should increase by app. $0.44, due primarily to the increase in the receiver cost.

- Pending complete dimensional inspections it seems that the LT-15M turning center (and by inference the LB-300) is capable of running repeatable, consistent parts. This initial conclusion is based on spot checks of critical dimensions of parts. The final conclusions will be based on inspections of the parts and statistical analysis of the data over the next two weeks.

- Due to the trouble encountered with the receiver, it is desired that a return trip to Okuma be planned to follow up with optimizing the receiver process so better definitions on tooling cost and cycle times can be created.

Please note that the above changes are taken in isolation and may be offset by other recent information (quotes, etc.).

Model 710 Engineering Trials Report

Conclusions (cont'd)

In conclusion, Remington now possesses solid, if somewhat un-optimized, machining processes for the chamber and bolt body complete, and it is felt by both Matthew Machinery and Okuma that a solid process is achievable for the receiver with an additional week's worth of work at Okuma. Beyond that, there are several opportunities and paths forward to decrease the run times and tooling costs from the values stated above, but they may take up to several months to implement and optimize.

Appendix A:

Tooling Cost Comparison – Estimate vs. Runoff

TOOLING COST COMPARISON - ESTIMATE VS. RUNOFF

Model 710 Component	Operation	Initial Tooling Cost Estimate (per part)	Revised Tooling Cost based on Runoff Data (per part)	Change in $ [Note: ( ) favorable]	% Change
Receiver	Machine Complete	$ 0.927	$ 1.433	$ 0.506	55%
Barrel	Gundrill	$ 0.119	$ 0.176	$ 0.056	47%
	Ream, Rifle	$ 0.386	$ 0.202	$ (0.184)	-48%
	Turn O.D.	$ 0.072	$ 0.091	$ 0.020	27%
	Chamber Complete	$ 2.762	$ 3.039	$ 0.277	10%
Bolt Body	Machine Complete	$ 0.240	$ 0.285	$ 0.046	19%
		Total Change-Variable Tooling		**$ 0.720**	

TOOLING COST COMPARISON - ESTIMATE VS. RUNOFF

Initial Estimate of Tooling Cost and Life				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part
MILL FIRE CONTROL SLOT, FINISH MILL MAGAZINE BOX SLOT	15/64 Carbide Endmill, 3-flute	$10.05	225	$0.045
ROUGH MILL MAGAZINE BOX SLOT,MILL RECEIVER TOP TANG RADIUS CUT	3/4 Carbide Endmill	$72.34	250	$0.289
CENTER DRILL FOR .265 CLEARANCE HOLE,SCOPE SCREW HOLES	3/8 NC Spot Drill	$13.95	450	$0.031
DRILL .265 CLEARANCE HOLE	17/64 Carbide Drill	$17.77	500	$0.036
ROUGH MILL EJECTION PORT,FINISH MILL EJECTION PORT,MILL BOLT STOP FLAT	1/2 Carbide Endmill	$25.59	400	$0.064
MILL EJECTION PORT MOUTH	Special 3/4 Endmill w/ .625 Spherical Radius	$133.85	500	$0.268
MILL BOLT HANDLE CAM/CLEARANCE CUT	3/8 Carbide Endmill	$15.97	225	$0.071
TAP DRILL FOR SCOPE SCREW HOLES	#30 Drill	$0.66	250	$0.003
TAP #6-48 SCOPE SCREW HOLES	#6-48 NS-2 Tap	$14.25	750	$0.019
DRILL .279 HOLE	7.1mm Drill	$18.80	500	$0.038
COUNTERBORE 1.227	Insert	$12.00	500	$0.024
CUT-OFF	Insert	$10.16	250	$0.041
			TOTAL COST PER PART (ESTIMATE)	$0.927

New Tooling and Costs based on Engineering Runoff Observations				
Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
.320 3-flute TiCN coated Carbide Endmill, Garr Tool EDP#12204 (21/64 or .328), Modified std	$33.01	225	$0.147	Modified std to get fire control slot to size; assumes design changes will allow magazine well radii to be changed to .160; new price assumed to Garr list price plus 20%
3/4 3-flute TiCN Carbide Endmill, Garr Tool EDP#12354, Modified std w/ .125 corner radius and short (1") flute length	$112.80	250	$0.451	Tool life lowered based on uncertainty caused by runoff performance of original endmill; new price assumed to Garr list price plus 20%
#3 TiN Coated Carbide Center Drill, Stores #306184	$18.20	600	$0.030	was 3/8 carbide spot drill; however, performance at run-off resulted in change; tool life based on 597 bbl assy (300 pcs. Per end; double-ended)
17/64 HSS Screw Machine Length Drill, MSC #63804462 (Cleveland Twist)	$1.66	250	$0.007	Was 17/64 Carbide 3-flute; change made based on run-off experience
15mm (.5906) 3-flute TiCN coated Carbide Endmill, Garr Tool EDP#12334 (5/8 endmill), Modified std w/ .06 corner radius	$79.54	250	$0.319	Tool life lowered based on uncertainty caused by runoff performance of original endmill; new price assumed to Garr list price plus 20%
Special 3/4" Endmill w/ .625 radius nose (2 flute). Modified standard of Garr EDP#51354. Cost equivalent to 597 hammer endmill, Stores #306633	$133.85	500	$0.268	Four flute tended to chatter on entry; need either a 2, 3, or 6+ flutes to eliminate chatter; price based on M/597 hammer endmill as worst case; tool life based on 1/2 of hammer endmill life
3/8 Carbide Endmill, 6-flute, TiCN coated, Garr EDP#51234	$26.12	225	$0.116	Based on 597 carbon bolt 1/4" emill at 225 pt/tool
#30 Drill	$0.66	250	$0.003	based on 597 barrels job
#6-48 NS-2 Tap	$14.25	750	$0.019	based on 597 barrel job
"K" (.281) HSS Screw Machine Length Drill, MSC #63792105 (Cleveland Twist)	$2.32	250	$0.009	Was 7.1mm carbide; change made based on runoff experience
Insert	$12.00	500	$0.024	
Insert	$10.16	250	$0.041	TL BASED ON 597 CUTOFF AND CROWN OPERATION
		TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$1.433	

Other recommendations:

1). May want to try inserted endmill for roughing 3/4 slot for magazine well. If it works the cost per part would most likely drop to between $.06 and $.15 per part (assumes $15.00/insert and tool life between 100 & 250 pcs per insert)

2). May want to add a small face mill to cut top tang and bolt stop flat. This would create better finish, and allow us to buy an LT-15 w/o the Y-axis option. Looking at a Sandvik Coro-Mill 200 or similar. This uses three round carbide inserts and is commonly used in the mold and die industry for milling contours.

TOOLING COST COMPARISON - ESTIMATE VS. RUNOFF

Initial Estimate of Tooling Cost and Life					New Tooling and Costs based on Engineering Runoff Observations				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
SPOT FACE FOR .250 C-DATUM HOLE,FINISH MILL CAM CUT	5/32 ENDMILL	$7.99	250	$0.032	3/16 6-flute Endmill, TiCN coated, Garr EDP# 51114	$11.47	400	$0.029	Used a 2-flute HSS TiN Coated Endmill for runoff with little wear after app. 130 pcs; carbide will give longer life and better finish
SPOT DRILL .250 C-DATUM HOLE,SPOT DRILL .250 BOLT HANDLE PIN HOLE	3/8 NC Spot Drill	$13.95	450	$0.031	#3 TiN Coated Carbide Center Drill, Sipres #306184	$18.20	600	$0.030	Replaced 3/8 NC Spot Drill with center drill
DRILL .250 C-DATUM HOLE,DRILL .250 BOLT HANDLE PIN HOLE	.250 CARBIDE DRILL	$16.33	250	$0.065	1/4 Carbide 2-flute Drill, TiCN coated, Screw Machine Length	$20.05	400	$0.050	was 3/8 carbide spot drill; however, performance at run-off resulted in change; tool life based on 597 bbl assy (300 pcs. Per end; double-ended)
MILL .125R SLOTS	3/16 CARBIDE ENDMILL,4 FLUTE	$6.82	225	$0.030	1/4 4-flute Carbide Endmill, Garr Tool EDP# 13150	$10.20	300	$0.034	
TURN FIRING PIN HEAD RETAINING GROOVE	KC 720 INSERT	$10.16	250	$0.041	KC 720 INSERT	$10.16	100	$0.102	Insert Broke at app. 90 pcs due to insufficient chip evactuation inside hole; can be overcome by tooling/coolant options
CUT-OFF	Insert	$10.16	250	$0.041	Insert	$10.16	250	$0.041	Four flute tended to chatter on entry; need either a 2, 3, or 6+ flutes to eliminate chatter; price based on M/597 hammer endmill as worst case; tool life based on 1/2 of hammer endmill life
			TOTAL COST PER PART (ESTIMATE)	$0.240			TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$0.285	

NOTES:
Tooling Cost for Cut-off & Spot Drill were omitted from original estimate - they are added here

Other recommendations:

Initial Estimate of Tooling Cost and Life					New Tooling and Costs based on Engineering Runoff Observations				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
Gun Drill	Drills	$10.02	100	$0.100	Drills	$23.50	150	$0.157	Cost is a composite o f new drill cost and regrinds; assumes 1 new drill @ $90, 5 regrinds @$12 ea, 1 re-tip @ @ $72, and 5 additional regrinds @ $12 ea.
Gun Drill	Bushings	$61.95	10,000	$0.006	Bushings	$61.95	10,000	$0.006	
Gun Drill	Gizmos	$4.50	1,000	$0.005	Gizmos	$4.50	1,000	$0.005	
cut off	saw blade	$16.80	2,000	$0.008	saw blade	$16.80	2,000	$0.008	
			TOTAL COST PER PART (ESTIMATE)	$0.119			TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$0.176	

NOTES:
Average Regrind Cost Mistakenly placed in tool cost for gundrill

NOTES:

Initial Estimate of Tooling Cost and Life					New Tooling and Costs based on Engineering Runoff Observations				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
Ream	Reamer	$97.90	1000	$0.10	Reamer	$126.55	1000	$0.13	
Rifle	Button	$576.00	2000	$0.29	Button	$300.00	4000	$0.08	
			TOTAL COST PER PART (ESTIMATE)	$0.386			TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$0.202	

NOTES:

NOTES:

	Initial Estimate of Tooling Cost and Life				New Tooling and Costs based on Engineering Runoff Observations				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
Rough Turn Barrel	Kennametal CNMS432	$12	300	$ 0.039	Kennametal CNMS432	$9	150	$ 0.059	Assumes two sides per insert
Finish Turn Barrel	Kennametal DNMG432LF	$14.63	450	$ 0.033	Kennametal DNMG432LF	$14.63	450	$ 0.033	Assumes four sides per insert
			TOTAL COST PER PART (ESTIMATE)	$0.072			TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$0.091	

NOTES:

NOTES:

Initial Estimate of Tooling Cost and Life					New Tooling and Costs based on Engineering Runoff Observations				
Operation	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Tool Name	Cost per tool	Tool Life (parts/tool)	Cost/Part	Comments
Face Breech End of Barrel	Insert	$10.80	1000	$0.011	Insert	$10.80	1000	$0.011	No Change
Rough C'Bore to .833 Depth	PILOTED CARBIDE STEP CORE DRILL	$184.78	400	$0.462	5/8 4-flute Endmill w/ .03 corner radius, Garr EDP#80390	$61.60	200	$0.308	Tool life approximate and may be low; endmill slipped in collet on last (93rd) part and pulled out. Endmill itself had some BUE but no damage. Most likely a workholding issue (need weldon flat or something similar). May need to switch to coated endmill or an inserted drill
Core Drill Chamber Body	27/64 Carbide 3-flute Drill	N/A	N/A	N/A	27/64 Carbide 3-flute Drill	$49.77	300	$0.166	Tool had some BUE on it on 93rd (last) part. Tool life approximate but based on actual machining results. Speed might be slow, or might need to coat tool
Rough Ream Chamber & Cut .025 Chamber Mouth Radius	PILOTED ROUGH CHAMBER REAMER	$185.20	300	$0.617	PILOTED ROUGH CHAMBER REAMER	$168.00	200	$0.840	Material gummier than expected; life reduced based on expectation of BUE ruining finish sooner than expected. Might need to coat tool (TiCN or TiAlN)
Finish Ream Chamber Complete	PILOTED FINISH CHAMBER REAMER	$185.20	300	$0.617	PILOTED FINISH CHAMBER REAMER	$168.00	200	$0.840	Material gummier than expected; life reduced based on expectation of BUE ruining finish sooner than expected. Might need to coat tool (TiCN or TiAlN)
Finish Counterbore .7045 dia., .708 Diameter, and 45 degree chamfer	FINISH C'BORE TOOL	$172.33	400	$0.431	Piloted Finish Counterbore Tool, Carbide Tipped, 3 flute	$214.00	400	$0.535	Counterbore tool worked well; speed might be low, as some BUE evident, but no major wear evident
T-slot cut .925 undercut and .02 x 45 degree chamfer	.625 DIA. FORM T-SLOT CUTTER	$106.25	200	$0.531	5/16 HS Cobalt T-Slot Cutter, 8 flute (cutting diameter 21/32[.656], shank diameter 23/64[.3594])	$39.85	200	$0.199	Standard T-slot cutter worked well but was slow. T-slot showed relatively little wear after 75 pcs.; slight BUE
Rough & Finish Mill Locking Lug Profile	7/32 DIAMETER 4-FLUTE CARBIDE ENDMILL	$17.00	400	$0.043	1/4 6-flute TiCN coated Endmill, Garr EDP#51154	$15.61	400	$0.039	Used non-coated, 4-flute carbide endmill with good results after 93 pcs; little wear visible. Switching to a 6-flute 1/4 endmill will likely result in decreased cycle time and extended life.
DEBUR LUG PROFILE	CARBIDE BURR	$12.50	2000	$0.006	CARBIDE BURR	N/A	N/A	N/A	Removed; added two passes to 1/4 endmill
Spot Drill for Two Takedown Screw Holes	N/A	N/A	N/A	N/A	#3 TiN Coated Carbide Center Drill, Stores #306184	$18.20	600	$0.030	Added spot drill to reduce wear on .213 endmill
Endmill two Takedown Scre Holes, Endmill Recoil Lug Slot	.213 DIAMETER SPECIAL END MILL W/ .015 X 45 CHAMFER	$13.57	500	$0.027	.213 DIAMETER SPECIAL END MILL W/ .015 X 45 CHAMFER	$13.57	250	$0.054	Very little wear visible after 93 pcs.; tool life lowered in anticipation of more wear from slotting operation
Tap 2 Takedown Screw Holes	1/4-28 TAP	$12.68	750	$0.017	1/4-28 TAP	$12.68	750	$0.017	Little visible sign of wear; tool life should be OK
			TOTAL COST PER PART (ESTIMATE)	$2.762			TOTAL COST PER PART (REVISED PER RUNOFF RESULTS)	$3.039	

Other recommendations:

TOOLING COST COMPARISON - ESTIMATE VS. RUNOFF

Component	Constraint Opertaion	Constraint Machine	Constraint Run Rate per Operation	Constraint Run Rate per Machine	Capacity @ 80% Efficiency	% of Total Time needed to run each part	% of Capacity to Make 20,000 guns per Year	% of Capacity to Make 40,000 guns per Year	% of Capacity to Make 60,000 guns per Year
Barrel	Chamber	LB-300 Lathe	0.09167	0.09167	43,985	100%	45%	91%	136%
Receiver	Machine Complete	LT-15 Turning Center	0.10000	0.13265	30,396	75%	66%	132%	197%
Bolt Body	Machine Complete	LT-15 Turning Center	0.03265	0.13265	30,396	25%	66%	132%	197%
Bolt Head	Machine Face	VMC w/ Pallet Changer	0.01981	0.03071	131,276	65%	15%	30%	46%
Bolt Handle	Machine Complete	VMC w/ Pallet Changer	0.01090	0.03071	131,276	35%	15%	30%	46%

Assumes:

1 Turning Center to turn both receiver blanks and bolt body blanks

2. *VMC runs both parts on a single pallet; total run rate is sum of the Bolt Head & Bolt Handle*

3. Capacity Constraints based on the following:

* *80% of theoretical machine run rate (parts per hour)* X 21 hr/day X 240 days per year

RECEIVER/BOLT
BODY MAKE/BUY

83

	Original Receiver 9/1/99	Revised Receiver 10/25/99	Revised Receiver 11/10/99	"Pink" Receiver 710	Original Bolt Body 9/1/99	Revised Bolt Body 10/25/99	Revised Bolt Body 11/10/99	"Pink" Bolt Body 710
Run Time	0.0055	0.0058	0.0058	0.0627	0.0032	0.0033	0.0033	0.0087
Material	1.76	2.18	1.71	3.70	0.74	0.74	0.60	2.20
Labor	0.06	0.06	0.06	0.66	0.03	0.03	0.03	0.09
Incremental Overhead								
Employee Benefits 58%	0.03	0.04	0.04	0.38	0.02	0.02	0.02	0.05
Tooling Costs	1.02	1.43	1.10	1.41	0.24	0.29	0.29	0.11
Deprciation	1.64	1.64	1.64	0.92	0.55	0.55	0.55	0.23
Property Taxes (.008 of Fixed Asset Costs)	0.18	0.18	0.18	0.14	0.09	0.09	0.09	0.06
Electricity (estimated)	0.08	0.08	0.08	0.08	0.04	0.04	0.04	0.04
Totals	4.76	5.60	4.80	7.31	1.71	1.76	1.62	2.78

	Receiver	Bolt Body	Total
Net Change - Manufactured Complete in-house vs. Purchase "Pink" version & perform secondaries	$ 2.51 increase	$1.17 increase	$ 3.67

Note: 1) Depreciation for receiver & bolt body based on 20,000 710s
2) Depreciation on Original & Revised Receiver & Bolt Body on $437,000 machine (LT-15MY) allocated on Capacity Run Time (receiver 75% Bolt Body 25%)
3) Depreciation on "Pink" Receiver based on $210000 (machine + fixtures) allocated 88% to receiver
4) Depreciation on "Pink" Bolt Body based on 12% of $185,000 (machine + rotary table) +100% of $25,000 in fixtures specific to bolt body

Changes:
New material prices for seamless tubing based on production quantities for 20,000 M/710's (receiver $2.76/ft & bolt body $1.18/ft.)
New tooling cost for receiver based on additional work performed by Okuma
Removed CMM cost from "pink" versions to make capital depreciation calculations consistent

Receiver Summary

art Name	Receiver	**Operation Name**	machine receiver
rt Number	300340	**Operation Number**	10

Material	Run Time	External Processing	Variable Overhead	Capital Required	Pre-op and Start Up
$3.70	0.06272	n/a	1.41825	$ 261,654.00	$4,564

Assumptions:

- This tooling is based on a vertical machining center using 40 taper holders.
- Assume seamless tubing for blank stock that has been cut to length and counterbored.
- Run-rate shown is at 80% efficiency
- Using "Pink" version of purchased blank @3.70 each. Price from Ken-Mar Tool
  - * 1.046 I.D.
  - * 1.227 C'Bore
  - * .320 Datum C Fire Control Slot
  - * Bolt Handle Cam / Clearance Cut
  - * Top Tang Cut
  - * Bolt Stop Face, Drill Point, and .279 Hole
- All Other Machining done in-house

Risks/unknowns:

- How well fixtures will hold parts for heavy milling cuts

CNC Machine Complete

Operation	Cutter Used	Cutter Dia.	Cut Depth/length (in.)	SFM	IPR	RPM	IPM	Cut Time (min.)	Rapid Traverse Time (min.)	Tool Change Time (min.)	Total Time per Operation (min.)
Rough Mill Magazine Box Slot	3/4 Carbide End Mill	0.7500	2.500	210	0.0120	1,070	12.83	0.195	0.03125	0.1	0.326
Spot Face for .265 Clearance Hole	15/64 Carbide End Mill, 3 flute	0.2344	0.188	210	0.0060	3,422	20.53	0.009	0.01667	0	0.026
Finish Mill Magazine Box Slot	15/64 Carbide End Mill, 3 flute	0.2344	8.000	210	0.0060	3,422	20.53	0.390	0.03125	0.1	0.521
Center Drill for .265 Clearance Hole	3/8 NC Spot Drill	0.3750	0.188	100	0.0050	1,019	5.09	0.037	0.03125	0	0.068
Center Drill for Scope Screw Holes	3/8 NC Spot Drill	0.3750	0.281	100	0.0050	1,019	5.09	0.055	0.03125	0.1	0.186
Drill .265 Clearance Hole	17/64 Drill	0.2656	0.218	100	0.0050	1,438	7.19	0.030	0.03125	0.1	0.162
Rough Mill Ejection Port	1/2 Carbide End Mill	0.5000	3.380	210	0.0120	1,604	19.25	0.176	0.03125	0.1	0.307
Finish Mill Ejection Port	1/2 Carbide End Mill	0.5000	6.750	210	0.0060	1,604	9.63	0.701	0.01667	0	0.718
Mill Ejection Port Mouth	Special 3/4 End Mill w/ .625 Spherical Nose	0.7500	3.250	210	0.0120	1,070	12.83	0.253	0.03125	0.1	0.384
Tap Drill for Scope Screw Holes	#30 Drill	0.1285	0.872	60	0.0050	1,784	8.92	0.098	0.03125	0.1	0.229
Tap #6-48 Scope Screw Holes	#6/48 NS-2 Tap	0.1380	1.700	70	0.0208	1,938	40.36	0.042	0.03125	0.1	0.173
Machine Deburr	Carbide Burr	0.1875	14.750	345	0.0200	7,028	140.57	0.105	0.03125	0.1	0.236
										Total Time per Part (min.)	3.011
										Total Time per Part (hr.)	0.0502
										Total Time per Part (hr.) @ 80% eff.	0.0627

NOTES:

* Cutter order optimized to eliminate excessive tool changes

Part Name	RECEIVER	**Operation Name**	MACHINE RECEIVER
art Number	300340	**Operation Number**	

Inspection Procedure

Machine or Tool	Feature Name		Dimension and Tolerance		Cost of Tool	COMMENTS
CMM	MAG SLOT					
	SCOPE SCREW LOCATION					
	.265 CLEARANCE HOLE					
	EJECTION PORT					
CMM FIXTURE					$4,500.00	BASED ON 597 CMM FIXTURE FOR THE BOLT
#6-48 THREAD GAGE	SCOPE SCREW THREADS				$225.90	BASED ON 597 BARREL THREAD GAGE

RECEIVER

RECEIVER

Tooling

Operation	Tool Name	Quantity	Cost per tool	Total Cost	Tool Life (parts/tool)	Cost/ Part	Lead Time	Comments
ROUGH MILL MAGAZINE BOX SLOT	3/4 CARBIDE END MILL	2	$112.80	$226	250	0.451		250 based on assumptions from 5X of 3/8" on M/700
	KENNAMETAL CV40DA188300	2	$140.41	$281				
	ERICKSON COLLET	2	$11.00	$22				
FINISH MILL MAGAZINE BOX SLOT	15/64 CARBIDE ENDMILL 3 FLUTE	2	$33.01	$66	225	0.147		based on no facts
	KENNAMETAL CV40DA188300	2	$140.41	$281				
	ERICKSON COLLET	2	$14.00	$28.00				
CENTER DRILL FOR .265 CLEARANCE HOLE, Scope Scre Holes	#3 Carbide Center Drill	2	$18.20	$36.40	600	0.030		based on 597 bbls and bolts see note below
	KENNAMETAL CV40DA188300	2	$140.41	$280.82				
	ERICKSON COLLET	2	$13.00	$26.00				
DRILL .265 CLEARANCE HOLE	17/64 HSS Screw Machine Drill	2	$1.66	$3.32	250	0.007		Garr drill assumed thin wall to give longer life
	KENNAMETAL CV40DA188300	2	$140.41	$280.82				
	ERICKSON COLLET	2	$14.00	$28.00				
ROUGH MILL EJECTION PORT	9/16 3-flute carbide endmill	2	$79.64	$159.28	250	0.319		Based on 597 carbon bolt 1/4" emill at 225 pt/tool
	KENNAMETAL CV40DA188300	2	$140.41	$280.82				
	ERICKSON COLLET	2	$14.00	$28.00				
FINISH MILL EJECTION PORT	1/2 CARBIDE END MILL	2	$39.48	$78.96	225	0.175		Based on 597 carbon bolt 1/4" emill at 225 pt/tool
	KENNAMETAL CV40DA188300	2	$ 140.41	$280.82				
	ERICKSON COLLET	2	$ 14.00	$28.00				
MILL EJECTION PORT MOUTH	SPECIAL 3/4 END MILL W/ .625 SPHERICAL NOSE	2	$ 133.85	$267.70	500	0.268		Price from hammer endmill price. TL is from based on m/597 hammers or 1000/ tool cut by 50%
	KENNAMETAL CV40DA188300	2	$ 140.41	$280.82				
	ERICKSON COLLET	2	$ 11.00	$22.00				
TAP DRILL FOR SCOPE SCREW HOLES	#30 DRILL	2	$ 0.66	$1.32	250	0.003		based on 597 barrels job
	KENNAMETAL CV40DA188300	2	$ 140.41	$280.82				
	ERICKSON COLLET	2	$ 26.20	$52.40				
TAP #6-48 SCOPE SCREW HOLES	#6-48 NS-2 TAP	2	$ 14.25	$28.50	750	0.019		based on 597 barrels job
	KENNAMETAL CV40SR372O SELF RELEASING TAP DRIVER	2	$ 567.86	$1,135.72				
	TAP ADAPTER #0	2	$ 40.05	$80.10				
	TOTAL PRE-OP DOLLARS			$4,564				
					TOTAL COST PER PART	1.418		

MF1292

Part Name	receiver	**Operation Name**	machine complete
Part Number	300340	**Operation Number**	10

Capital Required

Machine or Fixture	Dollars		Expected Delivery
CMM	$ 52,000.00		
Okuma Crown V-4018	$ 104,900.00		
32-Tool ATC	$ 6,426.00		
Trough-Spindle Coolant	$ 9,648.00		
Extra Memory	$ 1,750.00		
Tool Life Management	$ 3,480.00		
Tsudakoma RN-150 R-4 Rotary Table	$ 50,000.00		
Fixture for Rotary Table	$ 28,950.00		
OTAL CAPITAL	$ 257,154.00		

Bolt Body Summary

art Name	Receiver	**Operation Name**	machine receiver
rt Number	300340	**Operation Number**	10

Material	Run Time	External Processing	Variable Overhead	Capital Required	Pre-op and Start Up
$2.20	0.00869	n/a	0.10913	$ 24,800.00	$1,018

Assumptions:
This tooling is based on a vertical machining center using 40 taper holders
Assume seamless tubing for blank stock that has been cut to length and counterbored.
Run-rate shown is at 80% efficiency
Using "Pink" version of purchased blank @2.20 each. Price from Ken-Mar Tool
Assumes Blank consists of:
O.D.
I.D.
C-Datum Hole
Internal Undercut Groove
Firing Pin Assembly Cuts
All Other Machining done in-house

Risks/unknowns:
How well fixtures will hold parts for heavy milling cuts

CNC Cam Cuts, etc.

Operation	Cutter Used	Cutter Dia.	Cut Depth/length (in.)	SFM	IPR	RPM	IPM	Cut Time (min.)	Rapid Traverse Time (min.)	Tool Change Time (min.)	Total Time per Operation (min.)
Finish Mill Cam Cut	5/32 Endmill	0.1563	2.100	225	0.0060	5,500	33.00	0.064	0.03125	0.1	0.195
Spot Drill .250 Bolt Handle Pin Hole	3/16 Carbide Spotting Drill	0.1875	0.250	100	0.0050	2,037	10.19	0.025	0.03125	0.1	0.156
Drill .250 Bolt Handle Pin Hole	.250 Carbide Drill	0.2500	0.300	100	0.0050	1,528	7.64	0.039	0.03125	0.1	0.171
									Total Time per Part (min.)		0.521
									Total Time per Part (hr.)		0.0087

Part Name	RECEIVER	**Operation Name**	MACHINE RECEIVER
Part Number	300340	**Operation Number**	

Inspection Procedure

Machine or Tool	Feature Name		Dimension and Tolerance		Cost of Tool	COMMENTS
CMM						
CMM FIXTURE Incoming Inspection					see Capital	BASED ON 597 CMM FIXTURE FOR THE BOLT
CMM FIXTURE Machining					see Capital	
				Total		

RECEIVER
RECEIVER

Tooling

Operation	Tool Name	Quantity	Cost per tool	Total Cost	Tool Life (parts/tool)	Cost/ Part	Lead Time	Comments
Finish Mill Cam Cut	3/16 6-flute Endmill, TiCN coated, Garr EDP# 51114	2	$11.47	$23	400	0.029		250 based on assumptions from 5X of 3/8" on M/700
	KENNAMETAL CV40DA188300	2	$140.41	$281				
	ERICKSON COLLET	2	$11.00	$22				
pot Drill .250 olt Handle Pin Hole	#3 Carbide Center Drill	2	$18.20	$36.40	600	0.030		based on 597 bbls and bolts see note below
	KENNAMETAL CV40DA188300	2	$140.41	$281				
	ERICKSON COLLET	2	$14.00	$28.00				
Drill .250 Bolt Handle Pin Hole	1/4 Carbide 2-flute Drill, TiCN coated, Screw Machine Length	2	$20.05	$40.10	400	0.050		based on 597 bbls and bolts see note below
	KENNAMETAL CV40DA188300	2	$140.41	$280.82				
	ERICKSON COLLET	2	$13.00	$26.00				
	TOTAL PRE-OP DOLLARS			$1,018				
					TOTAL COST PER PART	0.109		

Part Name	receiver	**Operation Name**	machine complete
Part Number	300340	**Operation Number**	10

Capital Required

Machine or Fixture	Dollars		Expected Delivery
Fixture for Rotary Table	$ 15,800.00		
CMM Fixture - Incoming Inspection	$ 4,500.00		
CMM Fixture - Machining	$ 4,500.00		
OTAL CAPITAL	$ 24,800.00		

KEN-MAR TOOL, INC.

748 W. MAIN STREET
LEBANON, KY 40033
PHONE: 502-692-2208
FAX: 502-692-2271

QUOTE NO. 82699MM-1

CUSTOMER: REMINGTON ARMS COMPANY, INC.
22 RIFLE TRAIL
P.O. BOX 99
HICKORY, KY 42051

DATE: 8/26/99

PAGE 1 OF 1

ATTENTION: METTY E. MORGAN

PHONE 502-856-4200
FAX 502-856-3233

WE ARE PLEASED TO QUOTE THE FOLLOWING:

DELIVERY.	F.O.B. DELIVERED		TERMS NET 30 83	
TOOL NUMBER/DESCRIPTION		QTY	UNIT PRICE	TOTAL PRICE
E-300388 BOLT HEAD	NO QUOTE			
E-300340 RECEIVER				
PINK		20,000	$3.70	
		40,000	$3.55	
		60,000	$3.30	
YELLOW		20,000	$3.50	
		40,000	$3.35	
		60,000	$3.10	
O-300339 BOLT BODY				
PINK		20,000	$2.20	
		40,000	$2.10	
		60,000	$2.05	
YELLOW		20,000	$2.05	
		40,000	$1.95	
		60,000	$1.90	

NOTES:
PRICES ARE FOR MATERIAL AND LABOR ONLY

TOTAL

RESPECTFULLY SUBMITTED.

BY: STEVEN SPALDING EXT 235

MF1299

Crosrol *Precision CNC Machining Services*

Crosrol, Inc. Box 6488 Greenville, SC 29606 864-235-9681 FAX 235-1789

FAX TRANSMITTAL

PN: (864) 235-9681 FAX: (864) 235-1789
E-mail: goverton@crosrol.com
Web page: www.crosrol.com

TO: Metty E. Morgan cc // kr
AT: Remington Arms Company Inc.
FAX: 270-856-3233
FROM: George Overton.
DATE: Monday, August 30, 1999
SHEET# 1/1
REF: Crosrol Inc. Quote # 72999284

83

Dear Metty,

Thank you for your interest in Crosrol CMS and for the opportunity to quote some of your components for you.
Listed below are the prices per your RFQ 7/26/99.

PART #	DESCRIPTION	QUANTITY	PRICE (Each)
E-300340	Receiver	20,000	**$ 21.75**
		40,000	**$ 20.26**
		60,000	**$ 19.51**

The prices quoted are for the quantities shown.
The prices quoted include all tools, fixtures gauges, programs and set up.
The prices quoted are FOB Greenville SC.
The prices quoted are good for 90 days.
The price quoted does not include any prototype or pre-production quantities, if required, these will have to be quoted separately.

Should you require any more information, please do not hesitate to call me and thanks again for your continued interest in Crosrol CMS.

Regards,

George Overton.
Sales Engineer, CMS Division.

MF1300

Morgan, Metty E. FYI copy 01/06

From: Keeney, Mike
Sent: Thursday, January 06, 2000 11:56 AM
To: Morgan, Metty E.
Subject: RE: 710 Purchased Parts

Mett,
here's my thoughts per part:

300327 Receiver Insert-- Mold is complete, Joe to inspect parts
300333 Side Plate--OK to order tool
300334 Safety-- Do not order, waiting for marketing approval
300345 Bolt Stop--OK to order tool
300361 Recoil Bracket--OK to order tool
300360 Bolt Handle Blank--Do not order, waiting for knurling decision
300366 Bolt Handle Braze--OK to order
300368 Bolt Plug--OK to order tool
300336 Firing Pin Head--OK to order tool
300362 Magazine Latch--OK to order tool
300363 Magazine Box--Hold/may order prototype tool?
300364 Magazine Follower--OK to order tool
300365 Magazine Bottom--OK to order tool, indicate insert will be required for artwork 83

the partslist has all current levels of revisions, you should be linked to it to view, if not let kristan know, he can link you.

Any problems let me know'
Thanks
Mike

From: Morgan, Metty E.
Sent: Thursday, January 06, 2000 11:58 AM
To: Keeney, Mike
Subject: 710 Purchased Parts

01/06/00

Mike,

When you let me know which parts I can order, please include the latest and greatest Rev. level so I will be sure to use the
most current drwg. when ordering.

Thanks,
Mett

35

1/18/00

710 DAT

- Receiver / Bolt Body Tubing

Constraints: - Mag Latch

→ Order Safety Tool by end of week

* Call Weldaction about that Trial Hubs

Minimum of 300 for T&P

April 270 DAT → 10 guns

500 bbls → 700 blanks

M/710 Design Acceptance Test (DAT #1)

Test Plan

Model 710, New Centerfire Rifle

DRAFT

Revision # 1

03/07/00

Approvals

A meeting was held on _____, ____ 2000 to discuss the scheduled M/710 DAT #1 test. The purpose of this meeting was to define the test requirements for this Design Acceptance Test (DAT) scheduled to start in early March. During this meeting the test plan was reviewed step by step to determine what additional testing might be required to adequately test the product. This document lists the tests and procedures that have been agreed to by all meeting participants. Successful completion of these tests will qualify the Model 710 for Trial & Pilot evaluation.

The following people have reviewed this document and agree to this DAT #1 test protocol

Dale Danner _____
Research & Technology

Scott Franz / Jim Snedeker _____
Test & Measurement Lab

_____

Danny Diaz / Michael Keeney _____
Firearms Development

_____

M/710 CENTERFIRE RIFLE

DESIGN ACCEPTANCE TEST PLAN - DAT #1

Introduction:

This test is designed with the assumption that not all of the sample test guns will be available at the same start time. The initial test sample of 15 rifles will be delivered the second week in March (2000) and will be followed by an additional sample of 30-35 rifles delivered for test at a later time. Both sample sets are considered to be integral parts of the complete Design Acceptance Test Procedure.

The samples have been divided based on current estimates of sample delivery as follows. Rifles designated A1 to A15 are the first samples expected to be submitted for test on or about the 13th of March (2000) with a second group expected on about mid-May (2000) which will be designated as B1 to B30.

When successfully completing the proof test series, a 200 round per gun jack-function test is planned for the initial 15 rifle sample to quickly determine the probable malfunction rate and determine if the expenditure of further amounts of ammunition is justified by the performance of the product. Upon passing the jack-function test, the rifles will be subjected to a 20 rounds per rifle test (five rounds each of four different bullet types). These rifles will be shot from the shoulder (standing position) in the long range to confirm that the rifles function as intended when shot in the same manner as expected to be used by the customer.

Various inspection points and safety reviews are scheduled into the test program.

Note that samples A1 through A15 will be shot using 3 aluminum stocks that will preclude some tests such as recoil and drop testing. The samples scheduled for delivery in mid-May will have the synthetic stocks designed for this model. Those tests requiring the use of the final design stock will be run at that time. The Intentional Abuse tests are scheduled during Phase I, (for rifles A1-A15) but will be tested without the stocks in place. Although not currently scheduled these tests may be repeated during Phase II if necessary.

When additional samples are submitted in mid-May, the test rifles will again, with a few exceptions, be subjected to the full range of standard rifle test procedures, comprised of Measurements, Accuracy, Function & Endurance testing, Environmental and Abusive testing.

Initial Tests, Measurements and Inspections:

HEADSPACE AND PROOF - TLW0010A THROUGH TLW0010C:

TLW0010A – Measure Headspace

All test samples will be measured for headspace before being tested in either the jack or shot from the shoulder. The chamber, bolt face & locking lugs on both the bolt and the receiver will be inspected for the presence of dirt or debris. If dirt or debris that could affect headspace measurement is present then these areas of the firearm will be cleaned before using the gauges.

Method:

- The graduated headspace gauges based on Remington chamber dimensions (Ref.: Remington Gauge Drawing # 41560 …A, ...B, …C, & …D) will be used and the headspace measurements will be recorded to the nearest .001" increment as indicated by the gauge. The .30-06 Remington chamber drawing LB-153 will be used for chamber dimensions and LB-154 will be used for chamber drawings for the .270 caliber.
- The headspace measurements will be recorded to the nearest .001" increment as indicated by the gauge.
- If the measurement is taken at the start of the test then headspace should be less than Min. + .005".
- As the test progresses, headspace will be taken at each "Safety Inspection" scheduled in the plan and, in addition, at each "Clean & Inspect" activity scheduled by the plan.
- The readings for each firearm will be recorded on the "Daily Test Data Sheet" to be kept with each firearm in the accompanying data packet.
- For any firearms where the headspace is changing at each inspection point the firearm will be withdrawn from test and examined for the cause.
- In no case will any firearm in the test program be allowed to continue test if the headspace exceeds Min. + .009".

Data Required:

- Rifle serial number
- Headspace measurements for each sample

TLW0010B – Proof Test

All test sample firearms will be subjected to a standard .30-06 (or .270) Factory Proof Load, shot in the blow-up room using a lanyard. This procedure will be completed before the firearm can be used for any additional firing tests.

Before proof testing the firearm should be inspected for:

- Barrel Obstructions
- Bore and chamber are free of grease or oil and other debris.

For fully assembled firearms, one definitive proof cartridge should be fired in each firearm. Definitive proof ammunition is to be used in accordance with the "Handling of Ammunition" procedure defined in the SAAMI Technical Committee Manual, Volume III, Section II, Page 2410 as follows.

a. "Cartridges to be tested should be placed in a vertical position with primer end down in a recessed holding block."

b. "....a cartridge should be lifted vertically from the block. It should be rotated slowly, end over end, in a vertical plane through 360° pausing momentarily when the powder is at the bullet end and again when the powder is at the primer end."

c. "The cartridge is then rotated slowly, a minimum amount to enter chamber, keeping primer end in lowest possible position until inserted gently and carefully into the chamber."

d. "The cartridge should be seated in the chamber as far as practicable with the fingers. The bolt or breech mechanism should be closed gently in order not to disturb the position of the powder in the cartridge case. The object of this method of handling cartridges is to position the propellant powder at the primer end of the cartridge case by permitting it to fall gently against the primer and while rotating the case."

Note that these procedures for proof testing were developed to consistently position the propellant thereby providing greater consistency of proof pressures. Failure to follow this procedure during the definitive

proof testing of each chamber of the firearm could result in pressure levels significantly below the minimum proof pressure specification as determined for the cartridge.

Any firearms components, such as bolts, bolt heads, receivers including chambers, etc. which were previously subjected to proof testing and, which subsequently, have any proof sensitive components changed, altered, or substituted, should be re-proofed.

Method:

- Record headspace before proof testing *(see previous procedure "TLW0010A – Measure Headspace.")*
- After firing the proof round, the firearm will be carefully examined to determine if any damage to the product has occurred due to exposure to the proof pressure. This inspection includes:
- Visual inspection for damage,
    - damaged receiver or bolt, especially the locking lugs on the bolt or the receiver
    - bulged chamber or bore; split, cracked or otherwise damaged barrel,
    - broken stock,
    - any other part subjected to the proofing stress, which can be visually examined for damage.
    - Any "suspicious" areas should be submitted to magna-flux inspection before proceeding.
- Magna-Flux all bolt heads after Proof.
- The fired proof cartridge should be examined to determine that no firearm fault has introduced cartridge failure, such as:
    - Expanded cartridge head.
    - Excessive roughness, rings, or bulging, which would affect extraction.
    - Beginning separation or material stretching in front of the case head indicating excessive headspace or excessive pressure as stated above.
    - Any cartridge case failure indicating a firearm fault.
- In addition, the spent proof round should be examined for the presence of unusual deformation, split case or split head, and for any evidence of a pierced primer. Any of these conditions may be indicative that high-pressure gases may have vented into the action where other damage to components may have occurred.
- Take note of any indication of significant gas leakage, if present, it may indicate that the firearm was not subjected to full proof pressures and the proof test would then be invalid and would require re-proofing.
- A firearm is only properly proofed when the cartridge has been fired without evidence of significant gas leakage.

- Save the spent proof case in a Zip-Lock plastic bag and label and place in the data packet for further reference. If any parts were broken or otherwise damaged, place these parts in the same bag as the proof case and label. Place a label on the firearm and withdraw the firearm from the test.
- Each sample firearms' headspace *(see following procedure "TLW0010C – Re-Measure Headspace after Proof")* must remain in range from min. to min. +.007" after proofing, with no individual firearm's headspace to grow more than .002" after firing one proof round. After successful proofing, the right lug on the bolt head will be marked in the center (i.e. center of top to bottom and center or front to rear) of the lug with a center punch to indicate that is has been proofed.
- After proof, if the firearm passes the inspection and headspace has been measured (*see next section of test plan*), stamp the firearm on the barrel with an authorized Remington proof stamp. Locate the proof mark on the right rear of the barrel in the specified location for the Remington proof stamp. **DO NOT STAMP** if the headspace exceeds Min + .009".
- Because of the higher pressures involved in shooting proof cartridges, adequate precautions, both mechanical and procedural, should be taken to protect personnel performing the firearms proof testing. To this end, the firearm should be securely mounted, completely shielded from the operator and firing accomplished by a remote control method.

Data Required:

- Rifle serial number
- Record and note any headspace growth and the corresponding round level.
- Record significant gas leakage and/or firearm damage.
- Record any case damage or other ammunition related malfunctions.
- Record any damage to the firearm resulting from the proof test. Document with Photographs is necessary.

TLW0010C – Re-Measure Headspace after Proof

All test samples will be re-measured for headspace after proof and before being tested in either the jack or shot from the shoulder. The chamber, bolt face & locking block/locking notch will be inspected for the presence of dirt or debris. If dirt or debris that could affect headspace measurement is present then these areas of the firearm will be thoroughly cleaned before using the gauges.

Method:

- The graduated headspace gauges based on Remington chamber dimensions (Ref.: Remington Gauge Drawing # 41560 ...A (min.), ...B (+.005), ...C (+.007), & ...D (+.009)) will again be used and the headspace measurements will be recorded to the nearest .001" increment as indicated by the gauge. The .30-06 Remington chamber drawing LB-153 will be used for chamber dimensions and LB-154 will be used for chamber drawings for the .270 caliber.
- The headspace measurement taken prior to the proof test should be less than min. + .005". If, after proof, the growth of the headspace is more than + .002" from the pre-proof condition, then stop and review the results with the test manager before continuing to the next phase of the test.
- In no case should the measurement for headspace after initial proof test be greater than min. +007" for a new firearm.
- If at any time during the test program the headspace exceeds a maximum of Min. + .009" do not continue to fire the rifle, tag the gun with a label reading "Do Not Shoot This Firearm – Exceeds Maximum Allowable Headspace" and return the firearm to the Test Manager for disposition.

Data Required:

- Rifle serial number
- Record and note any headspace growth and round level.

FORGES – TLW0010D THROUGH TLW0010K:

TLW0010D - Measure Firing Pin Indent:

The firing pin indent will be measured for each of the sample rifles using SAAMI qualified copper crushers. The average of three trials per sample rifle will be calculated. The Average of three indents must be equal to or greater than 0.017".

Method:

- Using copper crushers, "burnish" both ends of the crusher slug by gently rubbing both ends on the granite base of the dial indicator stand (use outside edge of the plate.)

- Place the copper crusher in a .30-06 / .270-crusher holder, place the crusher holder on the base of the dial indicator and zero the dial indicator with the point of the indicator in the approximate center of the crusher.
- Carefully, with the gun held so that the muzzle is pointed down toward the floor, gently insert the crusher holder into the chamber, being sure that the extractor clearance cut on the crusher is properly oriented relative to the extractor position.
- While maintaining a firm hold on the bolt handle, gently, and slowly ease the bolt forward to the full forward position and then rotate down being sure that the action locks fully.
- Holding the firearm in a horizontal and level position, and pointing the firearm in a safe direction, pull the trigger until the firing pin releases.
- Carefully open the action and remove the crusher holder, being careful not to drop the copper crusher.
- Leave the crusher in the holder and place under the dial indicator.
- Move the crusher holder so that the point of the dial indicator finds the deepest portion of the firing pin indent.
- Record the dial indicator reading to the nearest .001".
- Repeat procedure two more times and record the dial indicator readings using a new copper crusher for each trial.
- Each firearm sample should have three readings that will be averaged.
- Record all three readings for the data file.

Data Required:

- Rifle serial number
- Each of the three trial indents
- The calculated average indent by rifle.

TLW0010E - Measure Sear/Trigger Engagement and Sear Lift:

The Sear/Trigger Engagement will be measured. The amount of engagement must be measured between .020" and .025" measured with the bolt in the fully closed and locked position.

Method for measuring Sear/Trigger Engagement:

- The 30" Optical comparator will be used to measure the engagement at 50X magnification.

- With the barreled action held firmly in position, the barreled action will be aligned such that the action is held perpendicular to the lens in both the horizontal and vertical planes.
- With action closed and locked, the safety in the "fire" position, measure the amount of overlap between the sear and the trigger.

Method for measuring Sear Lift:

- Remove the bolt from the action.
- Place the Safety in the "Off-Safe" (i.e. "Fire") position.
- With the action held firmly in a horizontal position pre-load the sear in the downward position using a small screwdriver and with a dial indicator zeroed on the top of the sear, gently rotate the Safety to the "On-Safe" position.
- Record the amount of vertical movement of the sear.
- Minimum sear lift is 0.006" and maximum sear lift is 0.018"

Data Required:

- Rifle Serial number
- Record Sear/Trigger Engagement
- Record Sear Lift

TLW0010F - Measure Trigger Pull Forces:

Trigger pull (force and displacement required to manually operate the trigger)

Method:

- Trigger pull is to be performed to the SAAMI standard; horizontal pull at the center of the finger radius of the trigger using the Test Lab apparatus designed for taking this measurement.
- Use the 1-10 lb. Chatillion Force digital force gauge.
- Force is measured parallel to the bore with the stock assembled to the action.
- Three pulls are to be taken on each sample rifle and the results averaged.
- The average force for the three trials must be between 3.5 lb. and 5.0 lb.

Data Required:

- Rifle Serial number

- All three data points for each trial rifle
- The average of the three measurements for each sample rifle.

TLW0010G - Measure Safe On/Off Forces:

Using the Chatillion Digital force gauge and the wooden holding fixture used to take trigger pull readings, push the Safe to the "Safe Off" position on each test sample. Complete three trials. Record all three readings for each firearm. Repeat the test, this time pushing the Safe to the "Safe On" position on each trial. Record all three readings. Average each of the three sets of readings in each direction for each test sample. These measurements are for information only. A minimum of 1 lb. force in either direction will be assumed as the reference criteria.

Method:

- Use trigger pull apparatus to hold the rifle for this test.
- Use the Chatillion Digital Force gauge (0-10 lb. range) with the disc point or the "v" shaped point. Use the same tip on all subsequent trials.
- Make three trials in each direction for each sample.
- Average the results of each of the three trials.
- For Phase II rifles, the ISS system will be checked.

Data Required:

- Rifle serial number
- Each of the three readings for each direction on each sample
- The average of each of the three sets of readings
- The results of the ISS system check.

TLW0010H - Measure Bolt Lift and Bolt Closing Forces:

The force required opening the bolt and closing the bolt will be measured for each sample. Both of these forces will be taken with the chamber empty and then repeated, this time with a new dummy round in the chamber. There is not a specification for these forces and the readings will be taken for information only.

Method:

- After locating the rifle in the trigger pull fixture and securely locking in place, (it may be necessary to clamp the fixture to the bench if not already securely fixed in place), locate the hook of the force gauge at the point on the bolt handle just behind the ball.
- With the chamber empty and using the Chatillion gauge, pull the gauge straight up and perpendicular to the bore, measure the force required to open the bolt.
- Lock the firearm in a horizontal position, using the trigger pull holding fixture, (i.e. shooting position) before taking the measurements.
- Take three readings for each gun in the sample.
- Record all readings.
- Repeat the procedure only this time push the bolt closed.
- Note that it may be necessary to start the bolt closed by hand so the firing pin head is depressed sufficiently out of the notch and can start up the cam surface of the bolt as the firing pin is cocked.
- Repeat the above procedure this time with a new, unused dummy round in the chamber.

Data Required:

- Rifle serial number
- Each of the three readings taken for each of the 4 states for each test sample
- The average of each set of three measurements per state

TLW0010I - Measure Magazine Spring Force:

The force produced by the compression of the Magazine Spring in the box with the follower attached will be measured. These measurements will be taken for information only. There is no specification currently defined for this characteristic.

Method:

- Use the Chatillion TCD200 Spring Testing Machine with the Chatillion Digital Force Gauge (0-10 lb. range). Use the disc probe (½ " dia.) on the gauge.
- Place the magazine box, bottom side down, on the staging table.

- Lower the gauge until it just touches the magazine follower, approximately in the middle location both side to side and front to rear.
- Lower the gauge 0.200" before starting to take the measurements.
- Zero the force gauge
- Lower the gauge another 1.0".
- Take the force measurement at this depressed location of the spring.
- Repeat procedure two additional trials for each box.
- Average the 3 trials for each box

Data Required:

- Force Measurements taken on each trial per box
- The Average Force measurement per box.
- The serial number of the Chatillion Digital Force Gauge used for the procedure.

TLW0010J - Measure Recoil Force:

Using the Remington designed recoil force device, measure the recoil forces for both the .30-06 and .270 caliber rifles. This test will only be done during Phase II with the synthetic stocks assembled to the actions. The measurements will be taken for information only.

Method:

- Assemble device to stock.
- Shoot the test in "blow-up" range using the jack. Fire the rifle remotely. (As an alternative, the rifle may be shot from the shoulder, with prior review of the safety status of the firearms.)
- Use the round with the heaviest available factory bullet.
- Shoot ten rounds per sample rifle.
- Average the ten rounds for each sample.

Data Required:

- Rifle serial number
- The peak force recorded for each shot
- A plot of each shot

- The average for peak force of the ten trials per rifle.

TLW0010K - Measure Lock Time:

Using the Remington method of measuring Lock Time, measure the lock time on the sample rifles provided. Do three trials on each sample rifle. Average the three trials. This data is for information only. The expectation is that lock time will be in the 3-msec. range. This test is scheduled for Phase I testing but may have to be postponed until Phase II if the metal stocks create a measurement problem.

Method:

- Standard Remington Lock Time Measurement procedure. (Sear Safety Cam release to 1st firing pin contact with the primer.)
- Measure three lock times per sample rifle

Data Required:

- Rifle serial number
- Each lock time trial
- Average lock time per rifle
- Settings used on the equipment.

WEIGHTS OF MAJOR COMPONENTS – TLW0010L THROUGH TLW0010O:

Note: The Weight measurements are scheduled for Phase II when the synthetic stocks are available for test.

TLW0010L - Overall Weight:

The test samples will be weighed on the Mettler Toledo digital balance (PB8000) located in the Metrology Lab. The rifles will be weighed once each with the chamber and magazine empty. The rifle will have only the open sights attached, no scope or other accessories attached.

Method:

- Clean the platen of the digital balance, if necessary.
- If the balance is not already on and has been turned on at least 30 minutes for warm-up, turn the balance on and wait 30 minutes for the balance circuitry to stabilize.
- Run the balance calibration routine if necessary.
- Make sure the units are set to "lb."
- With the chamber empty and the magazine box empty of rounds, carefully place the rifle on its left side with the rifles approximate front to rear balance point directly over the center of the balance platen.
- When the scale settles down, record the weight in lb. to the nearest 0.1 lb. (Note that the scale has three decimal points displayed.)

Data Required:

- Rifle serial number
- Weight to the nearest 0.1-lb.
- Serial number of the Mettler PB8000 balance (it should be SN 2114475246)

TLW0010M - Weight of Stock Assembly:

The stock, disassembled from the barreled action, will be weighed. (Synthetic stock only.) The test samples will be weighed on the Mettler Toledo digital balance (PB8000) located in the Metrology Lab. The rifle's stocks will be weighed once each.

Method:

- Clean the platen of the digital balance, if necessary.
- If the balance is not already on and has been turned on at least 30 minutes for warm-up, turn the balance on and wait 30 minutes for the balance circuitry to stabilize.
- Run the balance calibration routine if necessary
- Make sure the units are set to "lb."
- Label the stock as to which barreled action it came from
- Carefully place the stock on its left side with the stock's approximate front to rear balance point directly over the center of the balance platen.
- When the scale settles down, record the weight in lb. to the nearest 0.1 lb. (Note that the scale has three decimal points displayed.)

Data Required:

- Rifle serial number
- Weight to the nearest 0.1-lb.
- Serial number of the Mettler PB8000 balance (it should be SN 2114475246)

TLW0010N - Weight of Barrel Assembly:

The barreled action, disassembled from the stock, will be weighed. Remove the bolt assembly from the barreled action. The test samples will be weighed on the Mettler Toledo digital balance (PB8000) located in the Metrology Lab. The rifle's barreled actions will be weighed once each.

Method:

- Check to be sure that the bolt is correctly labeled with the last four digits of its rifle's serial number. This bolt assembly must be returned to its original rifle or the headspace may change.
- Clean the platen of the digital balance, if necessary.
- If the balance is not already on and has been turned on at least 30 minutes for warm-up, turn the balance on and wait 30 minutes for the balance circuitry to stabilize.
- Run the balance calibration routine if necessary
- Make sure the units are set to "lb."
- Carefully place the barreled action on its left side with the barreled action's approximate front to rear balance point directly over the center of the balance platen.
- When the scale settles down, record the weight in lb. to the nearest 0.1 lb. (Note that the scale has three decimal points displayed.)
- Re-assemble the stock on its corresponding barreled action.

Data Required:

- Rifle serial number
- Weight to the nearest 0.1-lb.
- Serial number of the Mettler PB8000 balance (it should be SN 2114475246)

TLW0010O - Weight of Bolt Assembly:

The bolt assembly, disassembled from the rifle, will be weighed. The test samples will be weighed on the Mettler Toledo digital balance (PB8000) located in the Metrology Lab. The rifle's bolt assembly will be weighed once each.

Method:

- Check to be sure that the bolt is correctly labeled with the last four digits of its rifle's serial number. This bolt assembly must be returned to its original rifle or the headspace may change.
- Clean the platen of the digital balance, if necessary.
- If the balance is not already on and has been turned on at least 30 minutes for warm-up, turn the balance on and wait 30 minutes for the balance circuitry to stabilize.
- Run the balance calibration routine if necessary

- Make sure the units are set to "lb."
- Carefully place the bolt assembly with the bolt assembly's approximate front to rear balance point directly over the center of the balance platen.
- When the scale settles down, record the weight in lb. to the nearest 0.1 lb. (Note that the scale has three decimal points displayed.)
- Re-assemble the bolt on its corresponding barreled action.

Data Required:

- Rifle serial number
- Weight to the nearest 0.1-lb.
- Serial number of the Mettler PB8000 balance (it should be SN 2114475246)

LENGTHS OF MAJOR COMPONENTS – TLW0010P THROUGH TLW0010R:

TLW0010P - Overall Length:

Phase II measurement of Overall Length of the firearm. For information only.

Method:

- Set butt of gun on the floor near a wall
- Bring the top of the barrel to the wall so that the top of the barrel lies even with the wall surface
- Measure the distance from the floor to the end of the muzzle using a tape measure.

Data required:

- Rifle Serial number
- Measurements for each sample rifle.

TLW0010Q - Barrel Length:

Measure the length of the barrel. For the .30-06 and .270 caliber, the barrel length should be 22" ± .125" measured from the bolt face to the end of the muzzle.

Method:

- Check firearm for live ammunition
- Close bolt over and empty chamber
- With the butt of the rifle on the floor and the muzzle pointing up, carefully and gently, so as to not scratch the bore or nick the rifling, insert a brass rod (not steel) into the muzzle of the rifle until it stops on the bolt face. Move the brass rod around to insure that you are on the bolt face and not on the edge of the ejector or extractor.
- Carefully mark the brass rod where it is even with the edge of the muzzle
- Remove the rod and measure the length.

Data Required:

- Rifle serial number
- Measurement of barrel lengths in inches.

TLW0010R - Length of Pull:

Length of Pull – the distance from the center of the butt plate (from center of top (i.e. heel) to center of bottom (i.e. toe)), to the inside curve of the trigger. Measurements are taken for information only.

Method:

- With muzzle of rifle pointed down and barrel clamped securely in holding device
- Located the center of the distance, top to bottom of the butt pad and mark pad or butt plate
- Measure to the inside curve of the trigger (at the front)

Data Required:

- Rifle serial number
- Length of Pull measurements

GUN CHARACTERISTICS – TLW0010S THROUGH TLW0010U:

TLW0010S - Balance Point:

Balance Point – Phase II measurement. Establish the balance point for this rifle. (This measurement will also be used later for the SAAMI drop and Jar-Off tests)

Method:

- Using a right angle block from the metrology lab, invert the block to provide a "sharp edge".
- Close the action over an empty chamber and with the magazine empty
- Using two hands, carefully place the shotgun in a horizontal orientation, over the edge of the angle block with the bottom of the firearm in the down position.
- Again, using two hands, one on each side of the block edge about one foot from the block edge front to rear, carefully place the shotgun on the edge and attempt to locate the balance point.
- With the assistance of another individual, place a light pencil mark at the likely balance point. After removing the shotgun from the edge, measure the distance to the breech face with the bolt in the closed position. (The position of the breach face was determined when the barrel length was measured. This location, that is, the breach face can be established by measuring the specific distance from the muzzle to outside of the receiver and marked accordingly. The distance from the balance point to this breach face mark is the location of the balance point.)
- Repeat this procedure for the following condition:
  - Using .30-06 dummy shells, place one in the chamber and four in the magazine, close the action and measure the distance to the bolt face.

Data Required:

- Record rifle serial number
- Record balance point with firearm empty
- Record balance point with firearm "loaded"

TLW0010T - Drop and Cast:

Drop at the comb – the distance from an imaginary line drawn along the top edge of the receiver to the foremost position of the comb.

Drop at the Heel - the distance from an imaginary line drawn along the top edge of the receiver to the point on the heel of the stock.

Both of these dimensions are for information only.

Cast off (or cast on) – Not required for rifle stocks.

Method: (for drop at Comb)

- Align the top of the receiver along back edge of the Drop Board
- Measure the distance from the Drop Board to the front-most position of the Comb
- Record the distance to the nearest 1/8"

Method: (for drop at Heel)

- Using the same procedure as mentioned above, measure the distance from the closest point on the top of the heel (just ahead of the butt-pad or butt-plate backer at the edge of the stock proper) to the back of the Drop Board. Record distance to nearest 1/8"

Data Required:

- Record rifle serial number
- Record drop at comb
- Record drop at heel

TLW0010U – 50 lb. Trigger Pull Test

This test is conducted to determine if the safety mechanism will release the trigger mechanism and cause the firearm to discharge if the trigger is pulled intentionally by the shooter with the safety on the "On-Safe" position. In addition, sufficient force is applied to the trigger with the safe in the "On-Safe" position to assure that the trigger dimensions will not change thereby affecting trigger/sear engagement. Prior to start of test verify that trigger pull, engagement and over-travel are within recommended specifications on the sample rifles.

- Inspect and verify the rifle is not loaded and the safe is in the "On-Safe" position.

- Locate the firearm in a vertical position with the muzzle pointed up.
- Using the set of plug gauges determine the amount of minimum clearance between the rear of the trigger and the inside rear of the trigger guard. This dimension will be used as a reference to see to the trigger has been deformed by the loading in the next steps.
- Carefully load a primed case into the chamber and close the bolt.
- With the safe in the "On-Safe" position, using the NRA trigger pull rod, load the trigger with a 50 lb. weight. **BE EXTREMELY CAUIOUS TO STAY CLEAR OF THE MUZZLE IN CASE THE FIREARM DISCHARGES THE PRIMED CASE.**
- Remove the load from the trigger.
- Move the Safety to the "Fire" position, the rifle must not discharge.
- Return the Safety to the "On-Safe" position.
- Carefully remove the rifle from the holding device and with the muzzle pointed in a safe direction, pull the trigger, the rifle must discharge. Extract the shell case.
- Using the plug gauges measure the minimum clearance between the rear of the trigger and the inside rear of the trigger guard.
- Measure the trigger pull, engagement and over-travel to insure that they have not changed from the beginning of the test.

Data required:

- Rifle serial number.
- Measurements of Trigger pull, engagement, over-travel and trigger/trigger guard clearance before and after loading.
- Note that the rifle "fired" or did not fire when the safety was pushed to the "Fire" position.
- Note that the rifle did "fire" when the trigger was pulled.

FIREARMS MEASUREMENTS – TLW0010V THROUGH TLWOO10Z:

TLW0010V - Chamber cast:

Use the .30-06-chamber drawing LB-153 for reference.

Method:

- Make chamber cast using standard procedure
- Use the 30" optical comparator
- Measure the following dimensions:
  - .4708/.4728
  - .4425/.4440
  - 34° 30" Angle
  - .3404/.3424
  - .3095/.3105

Data Required:

- Rifle serial numbers
- Record dimensions requested above.

TLW0010W - Bore Diameter:

Measure Bore Diameter using standard procedures.

Method:

- Measure .30-06 caliber
- Dimension equals .300/.301

Data Required:

- Rifle serial numbers
- Measurements of each bore by serial number

TLW0010X - Groove Diameter:

Measure Groove Diameter using standard procedures.

Method:

- Measure .30-06 caliber
- Dimension equals .308/.309

Data Required:

- Rifle serial numbers
- Measurements of each bore by serial number

TLW0010Y - Twist Rate (.30-06)

Measure Twist Rate using standard procedures.

Method:

- Measure .30-06 caliber
- 1 turn in 10" ± .25", RH

Data Required:

- Rifle serial numbers
- Measurements of each bore by serial number

TLW0010Z - Magazine Capacity Test:

Rifles with the magazine fully loaded must be able to be inserted into firearm with the bolt closed and in the locked position. Model 710 must be able to accept 4 rounds in the magazine and load into a closed bolt.

Method:

- Check rifle for live ammunition
- With muzzle pointed in a safe direction, close the bolt and lock over an empty chamber
- Load 4 dummy rounds into the magazine

- Insert magazine into the rifle, it must lock securely in place
- Cycle the 4 dummy rounds through the chamber and eject each round
- Remove the magazine box and repeat test two additional times per sample rifle using a different magazine box each trial.

Data Required:

- Rifle serial number
- Record any failures to load and cycle properly by box and rifle

FUNCTION & ENDURANCE TESTING:

FUNCTION AND ENDURANCE TESTING – TLW0010AA THROUGH TLW0010AE

TLW0010AA - Basic Jack Function Test (to 200 Rounds):

To get an early picture of the product's functional capability, a 200 round per rifle jack function test will be conducted. Five bullet types will be used, 40 round of each in each rifle to evaluate the potential for feeding problems. The test will be conducted in the test jacks with the "belly-protectors" in place and fully closed for each shot. All malfunctions and any unusual behavior will be noted on the data forms. The overall average of all sample rifles should be at or below 2-% malfunction rate. Up to two rifles from the sample of 15 are permitted to be removed from the averaging process if they have excessive malfunction rates relative to the remaining group of 13 samples. These rifles will be investigated by engineering to determine the probable source of the problem and engineering will provide written documentation for possible inclusion in the DAT report. No major mechanical failures are allowed in the test sample. Major mechanical failures are defined as those failures that cannot easily be repaired with simple tools and/or readily available replacement parts. At the conclusion of this test the firearms will be carefully examined for signs of excessive wear, especially with respect to the plastic components.

Method:

- Check each rifle for the presence of the proof stamp(s) – do not shoot unless the stamp(s) are present.
- Check each rifle for headspace
- Draw ammunition from stores – See test manager for ammo types to be used for this test.
- Each tester to have five rifles for test at any given time.
- The muzzle of each rifle will be inserted into the shooting port and the rifle placed securely in the test jack before the rifle is loaded.
- Load the five rounds into the rifle, one in the chamber and four in the magazine, do not shoot single shot by hand-feeding single rounds into the chamber.

- Push the safe to the "fire" position, be sure that the barrel is far enough within the port hole so that the muzzle will stay in the port when the rifle recoils. If there is any question, re-adjust the jack into a better position.
- With the lid on the belly protector closed, fire the first round in the chamber, listen for any off-sounds, and be alert for any other unusual behavior.
- Open the bolt; eject the spent round, note any extraction or ejection problems.
- Close the bolt to load the first round from the magazine into the chamber, note any feeding or stemming problems.
- Continue to fire the remaining rounds in the magazine until the last round is fired.
- Push the Safety to "On Safe" position, the safety will be pushed to the fire position at the start of every five round trial and will be pushed to the On Safe position at the end of every five round trial. Repetitive action of the safety lever on the trigger assembly side-plate needs to be determined. 83
- After firing twenty rounds (1 box of ammo) the rifle will be checked carefully for the presence of any live ammunition and if empty will be removed from the test jack and placed in the cooling rack. The safety will be in the "On Safe" position and the bolt will be unlocked and fully open at all times. Compressed air may be used, if necessary to cool the inside of the chamber area if the rifle is excessively hot from firing.
- All malfunctions will be recorded on the data sheets.

Data Required:

- Rifle serial number
- Tester's name
- Date of test firing
- The TLW#
- The ammunition used for the test with the ammo lot code number of the rounds actually used.
- Any malfunctions noted or other unusual items of note.

TLW0010AB - Basic Shoulder Function Test:

To get an early picture of the product's functional capability from the perspective of the customer, a 100 round per rifle shoulder function test will be conducted to evaluate the potential for feeding problems. These

malfunctions may be different from those noted in the jack test due to shooter reactions to recoil potentially affecting round position in the magazine box. The test will be conducted in the long range shooting from a standing position. Twenty-five (25) rounds each of four (4) different bullet types will be shot in each sample rifle.

All malfunctions and any unusual behavior will be noted on the data forms. The overall average of all sample rifles should be at or below the 2% malfunction rate. All rifles must pass the 2% criteria due to the small number of rounds being fired. No major mechanical failures are allowed in the test sample. Major mechanical failures are defined as those failures that cannot easily be repaired with simple tools and/or readily available replacement parts. At the conclusion of this test the firearms will be carefully examined for signs of excessive wear, especially with respect to the plastic components.

Method:

- Check each rifle for the presence of the proof stamp(s) – do not shot unless the stamp(s) are present.
- Check each rifle for headspace
- Draw ammunition from stores – See test manager for ammo types to be used for this test.
- Perform all range preparations required for shooting in the long range. Make sure the range ventilation is turned on.
- Wear safety glasses with side shields and double hearing protection.
- When ready to fire, the tester should stand in the doorway of the long range and when firing should be careful to keep the bullets in the center of the range to prevent damage to shields, lights, etc.
- Load the five rounds into the rifle, one in the chamber and four in the magazine, do not shoot single shot by hand-feeding single rounds into the chamber.
- Push the safe to the "fire" position,
- Fire the first round in the chamber, listen for any off-sounds, and be alert for any other unusual behavior.
- Open the bolt; eject the spent round, note any extraction or ejection problems.
- Close the bolt to load the first round from the magazine into the chamber, note any feeding or stemming problems.
- Continue to fire the remaining rounds in the magazine until the last round is fired.

- Push the Safety to "On Safe" position, the safety will be pushed to the fire position at the start of every five round trial and will be pushed to the On Safe position at the end of every five round trial. The effect of the action of the safety lever on the trigger assembly side-plate needs to be determined.
- After firing ten rounds the rifle will be checked carefully for the presence of any live ammunition and if empty will be placed in the cooling rack. The safety will be in the "On Safe" position and the bolt will be unlocked and fully open at all times. Compressed air may be used, if necessary to cool the inside of the chamber area if the rifle is excessively hot from firing.
- All malfunctions will be recorded on the data sheets.

Data Required:

- Rifle serial number
- Tester's name
- Date of test firing
- The TLW#
- The ammunition used for the test with the ammo code number of the rounds actually used.
- Any malfunctions noted or other unusual items of note.

TLW0010AC - Extended Function & Endurance:

This Endurance Test will be shot to accomplish two purposes. The first purpose is to determine an estimate of the product's expected malfunction rate over an extended period of shooting. The second is to determine both the estimated life of individual components as well as the expected life (in rounds) of the product before system failure occurs. For purposes of definition, a component failure will be one that prevents (or could prevent) the firearm from functioning as intended. These are failures that can be fixed relatively easily by the simple replacement of a part such as could be done by the gun owner using only simple household tools. System failures are defined as failures of a major nature, the extent of which would require specialized tooling or methods to repair not normally available to the average gun owner. Such a repair would be most likely made by a qualified gunsmith or by return to the factory.

This Endurance Test will be shot in the test jacks and the testers will use gloves for protection. The covers on the "belly-protectors" will be down and in-place for each test shot. Careful monitoring of each test gun is essential to evaluate the malfunction rate for each firearm.

The standard Remington test jacks will be used for all jack-related testing.

Each rifle will be shot, using a variety of Centerfire ammunition comprised of light, medium and heavy bullets. In addition, ammunition from the three major manufacturers (Remington, Winchester and Federal) of Centerfire ammunition shall be included in the mix.

Each rifle will be shot no more than 20 rounds before being put aside for cooling. Compressed air applied to the inside of the chamber will be an acceptable method to assist in the cool-down process.

The S.A.A.M.I. recommendation for the minimum acceptable malfunction rate for a bolt action rifle is a malfunction rate of < 2%. In this case, if the overall malfunction rate average for the test samples is > 2%, the DAT test will be stopped and the guns returned to Design for modification and improvement before being re-submitted for DAT. If the overall average malfunction rate is < 2% but one of the firearms is significantly greater than 2% malfunction rate, the test may continue with the other nine test samples while Design attempts to fix the problem with malfunctioning gun. After repair, this gun will again be required to pass the 200 round jack function test at < 2% malfunction rate. If the gun passes these criteria it will then be re-introduced into the Endurance test. It is important that total endurance rounds on the gun include any rounds that are put through the gun for re-test purposes.

The test will be performed according to Remington's standard endurance test procedures for centerfire rifle. Pyramid for this test will be ten rifles to 1,000 rounds, six rifles to 2,000 rounds, three rifles to 5,000 rounds and one rifle to 10,000 rounds.

Record all instances of malfunctions and failures, and replace parts when they become unserviceable noting the round level when they were replaced.

After every 100 rounds one live round will be extracted and ejected from the chamber to check on live round ejection. The ejected round will then be re-inserted into the chamber and fired to help keep the endurance round count accurate.

Method:

- Disassemble, thoroughly clean, lubricate per the design team's instructions, and reassemble. Record headspace for each.
- Fire each test firearm in accordance with the firing procedure (number of rounds, firing cycle) specified by engineering and the test plan.
- Ammunition will be used that comprises at least five types of bullets, change ammunition type every 100 rounds.

- Before commencing design acceptance testing, calibrate, adjust, or re-build the shooting jacks, if necessary.
- Allow the firearm to completely recover in the shooting jack between each shot and do not lean or "stiff arm" the firearm while shooting the gun.
- All ammunition is to be functioned through the magazine - no "single shot" hand feeding permitted.
- Allow the rifle to cool between cycles. One cycle is 20 rounds fired. The use of forced air to accelerate cooling of the barrels between firing trials is permitted. The air should be directed from the chamber toward the muzzle to prevent it from washing the lubricant from the firearm's action.
- Cycle the safety from fire to safe every 5 rounds, from Safe to Fire at the start of the five round cycle and from Fire to Safe at the end of the 5 round cycle.
- After every 1000 rounds, disassemble, inspect, clean and lubricate the entire mechanism and take all required measurements.
- At the initial 1000, initial 5000 and at the 10,000 round level, Magna-Flux the bolt heads.
- The Standard Remington Jacks are to be used for this test.

Data Required:

- Rifle serial number
- Tester's name
- The Test Jack Identification
- TLW#
- Date of actual testing
- Headspace every 1000 round interval.
- Malfunctions per ammo type, breakage, and replacement parts used.
- Any failure that requires the gun to be removed from testing completely.
- Notify management of any unusual events or malfunctions immediately.
- Any firing of the firearm without the trigger being pulled.
- Record ammunition lot code information as it is used throughout the test.
- Bullet type used for each 100 rounds of the test.
- The results and photographs, if any, of the Magna-Flux testing.

TLW0010AD - Clean Rifles and Inspect:

After each 1000 rounds of endurance, unless other wise specified, each rifle will be disassembled, cleaned and thoroughly inspected.

A list of inspection points will be provided in the gun packet for check-off and sign-off by the inspector. The inspector will be looking for any signs of unusual wear, especially on critical components and surfaces as well as for anything such as cracks or deformed material that might present a safety concern. Photographs will be taken to document unusual wear, damage or other notable characteristics.

TLW0010AE - Dry Cycle to 5000 Cycles:

The bolt assembly will be dry cycled to determine reliability due to mechanical wear as well as verify the long term performance and reliability of the bolt and receiver assembly. The M/700 dry cycle fixture will be used to perform this test by mounting the M/710 bolt / firing pin / firecontrol assembly and cycling to a 5000 cycle level. Bolt galling and other M/710 common part failures will be noted relative to this test.

Of particular interest in this test will be the effects of wear on the plastic components in the receiver and firecontrol.

For comparison purposes a new Model 700 fire control will be run in parallel through the dry cycle machine. Headspace will be checked on both actions at each 1000 round level to determine if the lugs are wearing excessively. Photographs will be taken at the start of the dry cycle test of the bolt lugs, cam surfaces and other critical wear areas and repeated at each 1000 cycle level. Photographs of each critical area will be taken twice at each inspection level, once before cleaning and once after cleaning. Each model will be lubricated after cleaning and inspection according to the instructions that will be found in its owner's manual.

ACCURACY TESTING:

ACCURACY AND POI TESTING – TLW0010AF THROUGH TLW0010AG

TLW0010AF - Point of Impact:

The point of impact test involves the verification of the firearms sighting system adjustment and the potential to hit the point of aim. The open sights must have sufficient adjustment in either direction when the rifle is sighted in at 100 yards. Random variation and/or extreme difference in shot to shot point of impact (as well as group size) typically indicate improper barrel processing and is used as a final inspection flag in production. This test will be shot from the bench with open sights. Shoot five 5-shot groups from each test rifle. Use the same code of ammunition for all point of impact test shots.

Method:

- Certify the ammunition selected for muzzle velocity and pressure.
- Pick the point of aim on the target
- Adjust point of aim to the bullseye at 100 yards.
- Slide must be adjusted to between the second line from the rear to third line from the front.
- The aperture must have the width of the screw retaining shoulder visible to either side.
- Shoot five "warmer" shots
- Shoot five, 5-shot groups

Data Required:

- Measure the center of the impact groups to the point of aim in terms of "x" and "y" positions.
- Record takedown screw torque
- Record position of slide when shot
- Record ammunition lot number used during the test
- Record and label any fail-to-fire ammunition

TLW0010AG - Group Size at 100 yards

This will be a Phase II test only. The barrels for Phase I will not have been angularity straightened. One hundred-yard accuracy testing will be completed utilizing standard factory ammunition. The test will consist of five, 5-shot groups. Guns will be cooled after every other group. Each firearm will be cleaned with five fouling shots prior to beginning the accuracy work-up. Group sizes will be measured from actual targets and recorded. Use the same code of ammunition and same type of ammunition will be used for all group size test shots. Average group sizes must be ≤ 3" at 100 yards.

Method:

- Certify the ammunition selected for muzzle velocity and pressure.
- Fire five, 5-shot groups at 100 yards, using a 36 power scope for each ammunition type selected. Prior to beginning of the test, clean the bore and shoot 5 "fouling" shots to seat in the rifle.
- Cycle the safety from fire to safe every 5 rounds.
- Accuracy should be shot from a recoiling rest. Shoulder shooting is acceptable but not the preferred way.

Data Required:

- Measure group sizes center to center
- Record takedown screw torque
- Record make and identifier of scope
- Record ammunition type used.
- Record ammunition lot numbers used during the test
- Record and label any fail-to-fire ammunition.
- Record any malfunctions that occur during the test.

ENVIRONMENTAL TESTING:

TEMPERATURE & HUMIDITY – TLW0010AH THROUGH TLW0010AK

TLW0010AH - Hot Function Test:

This test evaluates the effect of extreme high temperatures on the functioning performance of firearms.

Method:

- Condition test firearm and 100 rounds of ammunition of each caliber in a climatic chamber for at least 6 hours at a temperature of 120 degrees F. (or as close to 120 degrees F. as the equipment can be maintained.)
- Test each firearm within the chamber as follows:
  - Fire 20 rounds of ammunition. Wait 2 hours and repeat until all 100 rounds have been fired.
  - Do not perform maintenance during the 100 round cycle.
  - Cycle the safety from fire to safe every 5 rounds.
  - The tester should wear gloves to protect his hands from the hot metal.
- After 100 rounds have been fired through each firearm, remove the firearms from the conditioning chamber, disassemble, thoroughly inspect, clean and lubricate.

Data Required:

- Record temperature and exposure times
- Record all malfunctions.
- Record damage noted during inspection
- Record all necessary maintenance actions performed

TLW0010AI - Cold Function Test:

This test evaluates the effect of extreme low temperatures on the functioning performance of the firearms. Shoot the firearm from inside the environmental test cabinet in the long range.

Method:

- Condition the firearm and 100 rounds of ammunition of climatic chamber for at least 6 hours at a temperature of -20 degrees F.
- Test each firearm within the chamber as follows:
- Fire 20 rounds of ammunition. Wait 2 hours and repeat until all 100 rounds have been fired.
- Do not perform maintenance during the 100 round cycle.
- Cycle the safety from fire to safe every 5 rounds.
- After 100 rounds have been fired through the firearm, remove the firearm from the conditioning chamber, disassemble, thoroughly inspect, clean and lubricate.

Data Required:

- Record temperature and exposure times
- Record all malfunctions.
- Record damage noted during inspection
- Record all necessary maintenance actions performed

TLW0010AJ – Thermal Cycle Test:

This test evaluates the effects of large temperature changes due to expansion and contraction differentials of metallic and non-metallic components used in the Model 710. The sample rifle will be alternately cycled between a temperature of 120°F. and -40°F. for at least 3 complete cycles, brought back to ambient temperature and test fired in the test jacks for 200 rounds to evaluate both function and safety related characteristics.

Method:

- Shoot sample rifle in test jack to determine rifles malfunction characteristics and rate.
- Do not clean rifle
- Place rifle in freezer that is pre-set to -40°F and leave undisturbed for at least 24 hours.
- At completion of 24+ hours, remove rifle and immediately place in the pre-heated test chamber at a temperature as close to the +120°F as can be attained by the equipment. Leave rifle undisturbed for at least 24 hours.
- At completion of at least 24 hours, remove rifle and immediately place in the freezer.

- Repeat this cycle for a minimum of three complete hot and three complete cold cycles.
- At the completion of the final cycle (the heat cycle) remove the rifle from the chamber and allow cooling to ambient temperature – a minimum of six hours.
- Return the rifle to the test jack used at the start of the test and fire another 100 rounds recording malfunction types and rates.
- Remove the action from the stock and examine the rifle for any obvious signs that the thermal cycling has affected the parts with special attention directed at the metallic and non-metallic interfaces. Look for cracked parts and for signs of material creep.

Data Required:

- Rifle serial number
- Cycle time for each test condition
- Temperature records throughout each cycle. Use the chart feature on the freezer and a temperature-recording device for the chamber.
- Malfunctions type and rates both pre- and post thermal cycles.
- Observations made on cracks, creep or other noteworthy items.

TLW0010AK - Heat & Humidity Function Test:

Method:

- Shoot the firearm from inside the environmental test cabinet in the long range.
- Store the gun and ammunition for a minimum of six hours at a temperature of +100°F and 80-90% Relative Humidity.
- Shoot 100 rounds count and record all malfunctions or other unusual events.

Data Required:

- Record temperature and exposure times
- Record all malfunctions.
- Record damage noted during inspection
- Record all necessary maintenance actions performed

DEBRIS TESTING – TLW0010AL THROUGH TLW0010AN

TLW0010AL - Dynamic Sand & Dust Test:

This test evaluates the effects of blowing sand and dust on firearm performance, but the test firing is conducted after the firearm is removed from the sand and dust environment. Use the same sand and dust mixture used in the Sand and Dust Test,

(See Table No. 1.)

Method:

- Clean and lubricate one test firearm and close the muzzle with tape.
- Close the bolt. Set the safety in the SAFE position. Load the firearm using one primed case.
- Expose the firearm as follows:
- Place the firearm in the center of the box, and fasten the box lid.
- After 1 minute, stop the blowing air, remove the lid, and turn the firearm upside down in the box. Replace the lid and repeat the sand and dust blast for another minute.
- Remove the gun from the box after first attempting to wipe clean the firearm with gloved hands. Clean parts as much as possible by blowing the rifle with compressed or shaking the firearm. Carefully remove the tape from the muzzle. REMEMBER THAT THE RIFLE HAS A PRIMED CASE IN THE CHAMBER.
- Take the rifle to a test jack in the short range. (Note: if not shooting from the test box, remove the spent primed case from the chamber and replace with a live round.) Load the magazine with live rounds and fire a full magazine from the firearm while in the test jack.
- If firing is still unsatisfactory, attempt to fire with a clean magazine loaded with clean ammunition. If repeated malfunctions make it impossible to fire all of the ammunition, field strip and clean the firearm in accordance with the applicable operator's manual. Then attempt to fire the remaining ammunition. If

repeated malfunctions make it impractical to fire the remaining ammunition, stop the test. Cycle the safety from fire to safe every 5 rounds.

- At every 5 round interval verify the firearm is not loaded.
- Close the firearm as if to fire it and put the safety to the SAFE position
- Pull the trigger firmly (10 lb. maximum) - firearm must not fire.
- With the finger off the trigger, move the safety to the FIRE position - firearm must not fire.
- Disassemble the firearm over a large white paper and weigh the amount of debris present in the main mechanism

Data Required:

- Record malfunctions.
- Record number of rounds fired.
- Record weight of debris found in the gun.
- Record any firing of the firearm without the trigger being pulled.
- Record any misfires.

TLW0010AM – Static Sand & Dust Test:

This test is the second of two that evaluates the effect of sand and dust on firearm performance, where the test firing is conducted after the firearm has sand and dust directly placed in the action. Thus, an exposure box is not required. For Sand & Dust composition see Table No. 1.

Method:

- Clean and lubricate one test gun to the procedure supplied by the design team.
- Remove the bolt. Set the safety in the SAFE position and verify that the firearm is unloaded.
- Record the weight of one level tablespoon of debris mixture.
- Expose the firearm as follows:
- Place the firearm in a shooting jack, bottom of rifle up, and apply a tablespoon of sand in the firecontrol mechanism from the bottom. Tap the firearm three times, in the middle of the receiver, to jar the rifle and to assist getting sand into the mechanism.

- Turn the firearm to its normal upright horizontal position and apply a tablespoon of sand and dust to the top of the firecontrol mechanism from the top. Tap the firearm three times, in the middle of the receiver, to jar the rifle and aid sand getting into the mechanism.
- Replace the bolt. Wipe away any sand that prevents the bolt from closing.
- Load the magazine. Fire a full magazine from the firearm. If there are repeated malfunctions, attempt to fire with another magazine. If firing is still unsatisfactory, attempt to fire with a clean magazine, container, etc., loaded with clean ammunition. If repeated malfunctions make it impractical to fire the remaining ammunition, stop the test.
- At every 5 round interval verify the firearm is not loaded.
- Close the firearm as if to fire it and put the safety to the SAFE position.
- Pull the trigger firmly (10 lb. maximum) - firearm must not fire.
- With the finger off the trigger, move the safety to the FIRE position - firearm must not fire.
- Carefully disassemble the firearm over large sheet of white paper and weigh the amount of debris that finds its way into the main mechanism area.

TABLE No. 1. COMPOSITION OF SAND AND DUST MIXTURE (by percent particles, by weight, retained in sieves)		
Sieve Size (US gage sieve no.)	**Percent of weight retained**	**Particle Size (microns)**
20	3	842 to 1000
30	5	595 to 841
45	17	355 to 595
60	14	251 to 354
100	10	150 to 250
pass 100	less than 1	---
140-mesh silica flour		
140	1	105 to 149
200	4	74 to 105
325	7.5	44 to 74
pass 325	37.5	less than 44

Data Required:

- Record malfunctions.
- Record number of rounds fired.
- Record weight of debris found in the gun.
- Record any firing of the firearm without the trigger being pulled.
- Record any hang fires.

TLW0010AN - Field Debris Test:

This test determines the effect of "field debris" on firearm performance, where the firing is conducted after the firearm has field debris directly placed in the action. *See Table No. 2 for field debris composition.*

Method:

- Clean and lubricate one test gun to the procedure supplied by the design team.
- Remove the bolt. Set the safety in the SAFE position and verify that the firearm is unloaded.
- Record the weight of one level tablespoon of field debris mixture per following table.
- Expose the firearm as follows:
- Place the firearm in a shooting jack, turn bottom side up, and apply a tablespoon of debris in the firecontrol mechanism from the bottom. Tap the firearm three times, in the middle of the receiver, to jar the rifle and aid field debris getting into the mechanism.
- Turn the firearm to its normal upright horizontal position and apply a tablespoon of field debris to the top of the firecontrol mechanism from the top. Tap the firearm three times, in the middle of the receiver, to jar the rifle and aid the debris getting into the mechanism.
- Wipe away any debris that prevents the bolt from closing. Clean parts as much as possible by blowing sharply or wiping.
- Fire a full magazine from the firearm. If repeated malfunctions make this impossible, attempt to fire with another magazine. If firing is still unsatisfactory, attempt to fire with a clean magazine, container, etc., loaded with clean ammunition. If repeated malfunctions make it impractical to fire the remaining ammunition, stop the test.
- Cycle the safety from fire to safe every 5 rounds.
- At every 5 round interval verify the firearm is not loaded.
- Close the firearm as if to fire it and put the safety to the SAFE position
- Pull the trigger firmly (10 lb. maximum) - firearm must not fire.
- With the finger off the trigger, move the safety to the FIRE position - firearm must not fire.
- Disassemble the firearm over white paper and weigh or measure the amount of debris present in the main mechanism area. Debris should be removed from the parts for weighing.

Data Required:

- Record malfunctions.
- Record number of rounds fired.
- Record weight of debris in the gun at the conclusion of the test.

- Record any firing of the firearm without the trigger being pulled.
- Record any hang fires.

Table No. 2 - Field Debris Mixture (By Volume)	
Dried Grass Clippings	2 parts
Toothpicks (round, .25" long max.) to represent twigs	1 part
Bird Seed	1 part
Table Salt	1 part
Small Stones (.015" dia. to .125" dia.)	1 part
Crushed Dry Leaves	2 parts
Pine Needles	1 part
Hair Samples (no longer than 2 inch)	1 part

MISC. TESTS – TLW0010AO THROUGH TLW0010AP

TLW0010AO - Rain Test:

Use Standard Remington Rain test procedure. Rifle must function without any safety related malfunctions.

TLW0010AP - Solvent Testing:

For any non-metallic components in the M/710 that have not previously been tested for the effect of solvents, use Remington standard procedure to solvent test these new components. For some components where there is not enough material in one gun to properly test the sample, secure additional components from Design to complete the testing. If there are components that require testing then use the following procedure:

Tests will be conducted in accordance with ASTM D543-87, which calls for 24-hour immersion in solvents followed by a property evaluation. Hardness or stiffness is the property measured for this test, either quantitatively or qualitatively (where quantitative measurements were impractical). Solvent effects in polymers range from no effect to complete decomposition. Parts that absorb solvents may permanently discolor, crack, craze, or otherwise display failures. The parts also may simply take up solvent when immersed and yield the solvent back when exposed to air with no other property change other than temporary modulus (stiffness) reduction. To support this observation, it is often helpful to separate parts by their amount of solvent uptake, so that the large solvent uptake parts can be more carefully examined.

The receiver insert will be specifically tested for this DAT.

Method:

- Obtain untested chemicals.
- Weigh and obtain hardness readings on the test specimen(s).
- Place the specimen(s) in a container so that they are completely covered by the solvent. Leave at rest in the container for 24 hours.
- Remove and wipe the specimen(s) until they are dry. Weigh and obtain hardness readings on the test specimen(s).
- Leave the specimen(s) to air dry an additional 24 hours. Weigh and obtain hardness readings on the test specimens.
- The list of solvents, lubricants and production chemicals commonly used with and around firearms is found in below:

Remington Oil
Remington Bore Cleaner
Break Free Bore Cleaner
Birchwood-Casey Gunscrubber
Remington Action Cleaner
Hoppe's Oil
Hoppe's #9 Solvent
TPC Solvent
LP-1 Lubricant
Thin Film Lubricant
Steel Guard
Molycoat Paste
Molycoat Powder
Cobratec

Data Required:

- Record part weights before and after test.

- Record part hardness before and after test.

ABUSIVE TESTING

IMPACT TESTING – TLW0010AQ THROUGH TLW0010AV

TLW0010AQ - SAAMI Drop Test:

This test will simulate abusive dropping of the firearm from a distance of 48 inches onto a 1" thick 85 durometer (Shore A) rubber mat backed by concrete. Trigger Pull weight will be adjusted to minimum specification (3-½ lb.) The Trigger/Sear engagement will be set to the minimum specification (0.00"). Test will be performed according to SAAMI Technical Committee procedures. Magazine capacity will as well be according to SAAMI procedures. After each series of test, the primed case will be discharged to insure validity of test. This test will be performed on a sample of four firearms (for Phase I) and six firearms (Phase II) of .30-06 calibers only.

Method:

- With the firearm safety in the SAFE state, the firearm shall be capable of passing the below test criteria for drop testing from a height of four feet onto an 85±5 Durometer, Shore A, rubber mat, one-inch thick backed by concrete. The mat and concrete shall be large enough so that when the gun is dropped it will fall and come to rest without interference within the perimeter of the mat. The four feet shall be measured from the surface of the rubber mat to the center of gravity of the firearm. The center of gravity shall be determined to an accuracy of ± one inch by any recognized method for finding the center of gravity of an irregular shaped object. The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- The firearm or firearms shall be dropped in such a way as to strike the rubber mat surface once in each of the following attitudes:
    - Barrel vertical, muzzle down.
    - Barrel vertical, muzzle up.

- Barrel horizontal, bottom up.
- Barrel horizontal, bottom down.
- Barrel horizontal, left side up.
- Barrel horizontal, right side up.

- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol lubricated as in the owner's manual.
- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges and inserted in the firearm.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test. 83

Data required:

- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record round level

TLW0010AR - SAAMI Jar-Off Test:

The objective of the jar-off test is to simulate the abusive impacting (bumping) of the firearm against a hard surface with the firearm in a condition of maximum readiness. With the firearm in the ready to fire condition, the firearm shall be capable of withstanding a jar-off shock equivalent to being dropped from a height of 12" inches onto a 1" thick 85 Durometer (Shore A) rubber mat backed by concrete. Trigger Pull weight will be adjusted to minimum specification. The test will be performed according to SAAMI Technical Committee procedures. Magazine will be loaded to maximum capacity with dummy rounds according to SAAMI procedures. A fresh primed case will be chambered prior to each drop. After each drop the primed case will be discharged to verify its validity. This test will be performed on a sample of firearms made up of .30-06 caliber.

Method:

- With the firearm cocked and the safety in the FIRE position the firearm shall be capable of withstanding jar-off shock equivalent to being dropped from a height of twelve inches onto a 85±5 Durometer, Shore A, rubber mat, one-inch thick backed by concrete. The mat and concrete shall be large enough so that when the gun is dropped it will fall within the perimeter of the mat striking the mat once. The twelve inches will be measured from the test surface to the lowest point on the firearm. As an alternate to free dropping, other methods may be substituted if they provide equivalent impact characteristics. The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- The firearm or firearms shall be dropped in such a way as to strike the rubber mat surface once in each of the following attitudes:
    - Barrel vertical, muzzle down.
    - Barrel vertical, muzzle up.
    - Barrel horizontal, bottom up
    - Barrel horizontal, bottom down.
    - Barrel horizontal, left side up.
    - Barrel horizontal, right side up.
- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol lubricated per the owner's manual.
- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges and inserted in the firearm.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test.

Data required:

- Record engagement and trigger pull.
- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record the round level on the firearm.

TLW0010AS - SAAMI Rotation Test:

The test will be conducted according to SAAMI Technical Committee procedures. The firearm will be placed in the "Safe Carrying" condition and dropped from an upright position with its butt resting on the surface of a 1" thick 85 durometer (Shore A) rubber mat backed by concrete. Trigger Pull weight will be adjusted to minimum specification. Magazine capacity will as well be according to SAAMI procedures. The firearm shall be tested (dropped) on both the right and left sides. After each rotation, the primed case will be discharged to insure validity of test.

In addition, should the alternative test be performed a dummy round should be chambered prior to the drop.

Method:

- With the firearm safety in the SAFE state, the firearm shall be capable of passing the below test criteria when allowed to fall freely from an upright position with its butt resting on the surface of a 85±5 Durometer, Shore A, rubber mat, one-inch thick backed by concrete. The mat and concrete shall be large enough so that when the gun falls it will come to a rest without interference within the perimeter of the mat. The firearm shall be tested so as to fall once on its right-hand side and once on its left-hand side. The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol lubricated per the owner's manual.
- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges, inserted in the firearm.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required

than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test.

Data required:

- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record round level on the firearm

TLW0010AT– Extended SAAMI Jar-Off Test: (for Information only.)

With the intent to establish design margin this test simulates the abusive impacting (bumping) of the firearm against a hard surface with the firearm in a state of maximum readiness under conditions more severe than the SAAMI recommendations. This test will be performed on a sample of six (Phase II) (or the number available after performing the std. SAAMI tests) firearms.

Method:

- With the firearm cocked and in the safety in the FIRE position the firearm shall be capable of withstanding jar-off shock equivalent to being dropped from a height of 6 inches, 18 inches, 24 inches, and 48 inches onto a 85±5 Durometer, Shore A, rubber mat, one-inch thick backed by concrete. The mat and concrete shall be large enough so that when the gun is dropped it will fall within the perimeter of the mat striking the mat once. The distance of drop will be measured from the test surface to the lowest point on the firearm. The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- The firearm or firearms shall be dropped in such a way as to cause it to strike the rubber mat surface in each of the following attitudes:
    - Barrel vertical, muzzle down.
    - Barrel vertical, muzzle up.
    - Barrel horizontal, bottom up
    - Barrel horizontal, bottom down.
    - Barrel horizontal, left side up.

- Barrel horizontal, right side up.

- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol well lubricated with Rem-Oil.
- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges and inserted in the firearm.
- Conduct this test at 6 inches, 18 inches, 24 inches, and 48 inches.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test.

Data required:

- Record engagement and trigger pull
- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record the round level on the firearm

TLW0010AU – Extended SAAMI Rotation Test: (for Information only.)

With the intent to establish design margin this test simulates the abusive fall of a firearm when left leaning against a vertical surface under conditions more severe than the SAAMI recommendations. This test will be performed on a sample of six (Phase II) (or of those still available) firearms.

Method:

- With the firearm safety in the SAFE state, the firearm shall be capable of passing the following test criteria when allowed to fall freely from an upright position with its butt resting on the surface of a tiled floor backed by concrete. The firearm shall be tested so as to fall once on its right-hand side and once on its left-hand side. The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol well lubricated with Rem-Oil.

- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges, inserted in the firearm.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test.

Data required:

- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record round level of the firearm.

TLW0010AV – Extended SAAMI Drop Test: (for Information only)

With the intent to establish design margin this test simulates abusive dropping of the firearm in conditions more severe than the SAAMI recommendations. This test will be performed on a sample of six (or of those still available) firearms.

Method:

- With the firearm safety in the SAFE state, the firearm shall be capable of passing the below test criteria for drop testing from a height of 6 feet and 8 feet onto a 85± 5 Durometer, Shore A, rubber mat, one-inch thick backed by concrete. The mat and concrete shall be large enough so that when the gun is dropped it will fall and come to rest without interference within the perimeter of the mat. The drop height shall be measured from the surface of the rubber mat to the center of gravity of the firearm. The center of gravity shall be determined to an accuracy of ± one inch by any recognized method for finding the center of gravity of an irregular shaped object.
- The primed case shall be discharged following the drop and a fresh primed cartridge re-chambered prior to the next drop. A "fresh" firearm may be substituted into the test at any point.
- Test Procedure - The firearm or firearms shall be dropped in such a way as to strike the rubber mat surface once in each of the following attitudes:
    - Barrel vertical, muzzle down.
    - Barrel vertical, muzzle up.

- Barrel horizontal, bottom up.
- Barrel horizontal, bottom down.
- Barrel horizontal, left side up.
- Barrel horizontal, right side up.

- Tests shall be conducted with the trigger pull force set at the minimum force specified, with engagement set to the minimum specified, and with the firecontrol well lubricated with Rem-Oil.
- The test shall be conducted with the magazine or clip fully loaded with dummy cartridges and inserted in the firearm.
- Parts breakage or other damage as a result of drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop. More stocks are required than the amount of test guns to allow for breakage due to the drop testing. If a stock cracks - replace before continuing test.

Data required:

- Record whether or not the firearm fires an empty primed case of its designated cartridge when tested in accordance with this procedure.
- Record round level on the firearm.

INTENTIONAL ABUSE- TLW0010AW THROUGH TLW0010AY

TLW0010AW - Pierced Primer Test:

For this test, a firing pin will be altered to have a "wedge-shaped" point. This type of firing pin point should produce a pierced primer when fired. The purpose of piercing the primer is to allow high-pressure gases to escape into the action and thereby determine the effect of high-pressure gases when dumped into the bolt, magazine box and receiver areas. All standard Remington high-pressure ammunition safety procedures will be used for this test. A standard round of .30-06 ammunition will be used.

After firing the rifle will be examined for damage. Photographs of damaged components will be taken and kept for record. The rifle will be tagged and saved for possible future review.

Method:

- Position firearm in test jack located in the "Blow-up" room with the muzzle through the port.
- Set witness paper at the rear of the action perpendicular to the bore.
- Locate witness paper at the approximate location expected for the shooter's face.
- Set up the High Speed Video to tape the firing test.
- Fasten a lanyard around the stock and run through the trigger guard in front of the trigger.
- Load a standard factory .30-06 round into the chamber, and carefully close the bolt.
- All personnel are to leave the room.
- When ready to conduct the test start the high speed video and pull the lanyard.
- Carefully examine the scene looking for any broken or missing parts, holes in the witness paper etc.

Data Required:

- Rifle serial number.
- The condition of the witness paper.
- Notes of any broken or missing parts.
- Photographs of broken or missing parts.

TLW0010AX - High Pressure Test:

The rifle will be tested to 120,000 psi. The purpose of this test is to determine the extent of damage if an individual does purposely or accidentally handload an extremely high pressure load. Use standard Remington high-pressure ammunition safety procedures for these tests. The pressures for the test round will be worked up using various grain size loads giving pressures below 95,000 psi, (approaching the limits of the transducer gauges.) The grain size load will be plotted and a curve extrapolated to determine the load expected to produce a load of approximately 120,000-psi.

All testing will be done in the blow-up room using the high-speed video camera and witness paper. Before removing or otherwise disturbing the test samples after blow-up, photographs will be taken for the record. After collection and removal of the parts additional photographs of the various individual components will be taken for the record. All parts and will put in sample bags, boxed and temporarily stored for review if required.

TLW0010AY - Obstructed Bore Test:

One of the sample rifles will have a rifle bullet driven into the bore to a position immediately ahead of the chamber. A standard round (.30-06, 220 gr. factory load) will be loaded and fired remotely. All testing will be done in the blow-up room using the high-speed video camera and witness paper. Before removing or otherwise disturbing the test samples after blow-up photographs will be taken for the record. After collection and removal of the parts additional photographs of the various individual components will be taken for the record. All parts and will put in sample bags, boxed and temporarily stored for review if required.

Mayfield Visit, Dec. 6, 1999
Attendance: Mayfield -- M. Golemboski, J. Zajk, S. Truax, G. Helmer
R&D -- D. Diaz, E. Schoppman, M. Keeney

M/ 710 Review:

Stock Grip Cap - Mayfield to investigate alteration of current M/700 grip cap mold to allow for common usage of grip cap for M/700 and M/710. If alterations are not possible, the development of a M/710 specific mold will be required.

Bolt Handle Assembly - Modification of the bolt handle pin will be required to eliminate burrs generated while pressing the pin into the bolt handle. The bolt body clearance cut on the bolt handle will be altered to .690" dia. to improve the braze characterisitics.

Receiver and Bolt Body Drawings - Alterations requested by Mayfield to improve design intent relative to location and inspection of the components.

Magazine Bottom and Follower - The two components will be molded in a family tool, thus common material specifications are required.

Magazine Box - R&D will contact Deer Park Stamping to review possible coining operations to remove sharp edge on underside of feed lips. Drawings will be updated following the determination of resultant geometry.

Latch - Mayfield will quote as a Powder Metal component as back up to current synthetic direction. Based on cost, the group will decide if a metal latch is feasible. Concern is that the revised latching surface of the box may deform a synthetic latch. R&D to review synthetic material selection.

Stock Bushing Assembly - Mayfield to review stock bushing assembly and advise if there are design issues with current system.

Receiver Insert - Inspection report, program and fixture due this week, following setup, current receiver inserts will be inspected. Tool corrections to be based on inspection data and then trial quantity (1000-5000 pcs) of receiver inserts will be ordered.

Bolt Plug with ISS - R&D to generate exploded view of assembly. Mayfield to locate ultrasonic welder and proceed with assembly process development. Mayfield to investigate alternative processes to manufacture the bolt plug, such as investment casting.

DAT Schedule - Design Acceptance Testing of 30-06 caliber firearms is scheduled to begin mid February, based on delivery of receiver and bolt body tubing. Mayfield vendors will be used to provide as many of the components as possible based on delivery schedules. Mayfield to investigate procurement of MIM material blanks for machining of firing pin heads. Final assembly of the DAT firearms will be in Mayfield. Following successful completion of the 30-06 DAT, the 270 DAT will follow in April.

Bolt Action Rimfire Review:

R&D presented the staffing and program direction for the Bolt Action Rimfire introduction. The first phase of the program will be to develop and verify a design concept. Upon preliminary verification of the design function through initial prototyping, process development and costing will follow. The objective is to have a detailed schedule by the end of January 2000.

Confidential

Remington Arms Co.

To: **Mike Keeney; D. Diaz**

From: **Matt Golemboski**

CC: **Joe Zajk**

Re: **M/710 Vendor Tooling**

Date: **12/10/99**

M/710 RELEASE OF CAPITAL TOOL BUILD

We are at the point some tooling must be ordered to maintain schedules. Below is a list of the tooling and what the current state of the design, and preferred vendor name and contact. Some of the parts do not have a firmed design. Tool build can not begin until the design is completed. I would suggest R&D and Mayfield jointly contact the preferred vendor for each part, in order to keep cost controlled during the final during the finalization of the design.

Trigger C-15280
Vendor: Sterling Sintered
Contact: John Bartrum
Phone: 860-379-2753
The best costing to date does not include the serrations on the finger radius of the trigger. A print must be generated to order tooling. Once the drawing is issues tool build will begin immediately.

Safety D-300408
Vendor: New Hampshire Stamping
Contact: John Maffco
Phone: 603-641-1234
The texture on the top of the part has not yet been defined per marketing request.

Bolt Stop D-300345
Vendor Sterling Sintered
Contact: John Bartrum
Phone: 860-379-2753
Assume design is complete, with the exception of material change to MPIF standards. Tool will be released for build by 12/20/99. Impact of design change will be a scrapped tool.

Bolt Handle Blank C-300360
Vendor: North American Precision Casting
Contact: William Sommerville
Phone: 662-245-1155
Design requires knurling as per marketing request. Print should define parting line location and acceptable size notes, as well.

Bolt Plug C-300368
Vendor: Kellums and Coe
Contact: Kenny Ulrich
Phone: 812-283-4435
Design is complete. Texturing not specified, assume EDM finish. PO to be issued by 12/15/99.

Tumbler Blank D-300420
Vendor: PMPd
Contact: Matt Marley
Design is complete and ready to issue to tool build. Will be issued by 12/31/99.

Firing Pin Head C-300336
Vendor: Megamet Industries
Contact: Jim Mullineaux
Phone: 314-739-4499
MIM Blocks for DAT testing are being made. Paramatech will not quote on lower volume, 20,000 units. The lead time prohibits waiting until February for testing. With a material change to MPIF standards, Mayfield will then assume design is complete and will start tooling by 1/10/00.

Stock Dwg-xxxxxx
Vendor: Par 4
Contact: Sam Todd
Phone: 502-965-9141
Tool has been issued for build. Model to be revised by 12/10/99 for new coring to accommodated the M/700 grip cap. Method of attachment has will be press fit at molding time of the stock. The assumption is no alteration of the grip cap will be required for this fit.

Magazine Latch C-300362
Vendor: Par 4
Contact: Sam Todd
Phone: 502-965-9141
Tool issued and canceled. Design on hold to convert to metal part. Powder metal option with Sterling Sintered was a quote. Suggested a die cast or investment cast or MIM. PM is and option but print must be made specific for PM.

Magazine Box E-300363
Vendor: Brainin
Contact: Richard Lee
Phone: 513-874-5486
Prototypes to be Released 12/10/99, 500 piece lot, DAT and T&P run. Upon first week of DAT testing the Production too will be released for build.

Magazine Follower D-300364 and Magazine Bottom D-300365
Vendor: Par 4
Contact: Sam Todd
Color not yet approved by marketing. Material must be common to both on the family mold. Follower is complete. The box bottom is not defined for artwork. This will impact the insert sizing. Design and build to be released by 12/10/99. Build will be conditional of artwork approval on the magazine bottom.

Magazine Spring C-300405
Vendor: Brainin
Contact: Richard Lee
Phone: 513-874-5486
Design is complete. PO will be issued by 12/31/99.

Confidential

Remington Arms Co.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 12/10/99

Re: M/710 Meeting

I would like to hold a 1:00pm meeting on Dec.10. Be prepared to discuss the following items:

83

	Topic	Completion Date	Delivery Date
Barrels:	Is material ordered through Ilion		1/10/99
	Heat Treat Schedule	11-17	
Bolt Head	Machining Schedule	12/16	
	Grinding Schedule	12/31	
Bolt Handle	Finished Print	Keary	
	Order Tool		
		ESS with Matty	
Bolt Plug	Order Tool		
Firing Pin Head	Order Block of Material	12/20	
	Order Tool	1/23/00	
F. Screw Bush	Material	J. Smith	
	Samples		
Magazine Latch	Material — Talk w/ Mike		
	Cancel Par 4 PO	12/10/99	
Magazine Box	Order 500 at $13.17 each Mayfield Cost	12/13/99	
	Etown pay $12,500 tooling charge		
Range	Design PO and Start	12/10/99	
	Expected Design Completion		1/31/00
Ultra Sonic Welder	Shipment from Ilion		

Remington Arms Co.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/19/00

Re: M/710 Meeting

I would like to hold a 1:00pm meeting on Dec.10. Be prepared to discuss the following items:

	Topic	Completion Date	Delivery Date
Barrels:	Is material ordered through Ilion		
	Heat Treat Schedule		
Bolt Head	Machining Schedule		
	Grinding Schedule		
Bolt Handle	Finished Print		
	Order Tool		
Bolt Plug	Order Tool		
Firing Pin Head	Order Block of Material		
	Order Tool		
F. Screw Bush	Material		
	Samples		
Magazine Latch	Material		
	Cancel Par 4 PO		
Magazine Box	Order 500 at $13.17 each Mayfield Cost		
	Etown pay $12,500 tooling charge		
Range	Design PO and Start		
	Expected Design Completion		
Ultra Sonic Welder	Shipment from Ilion		

Remington Arms Co.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/16/00

Re: M/710 Magazine Spring 300405

During the initial quoting process the magazine spring did not have a print. The M/700 magazine spring was used for costing. In October the design of the magazine spring 300405 was received. This was quoted by at least two people F&G Multislide and North American Spring and Stamping. Brainin should be in this mix, because we may want to ship the box bottom and follower from Par 4 to Brainin and receive a part complete. North American should be dropped due to the comments about quality on the quote, I do not want to purchase a blank an have to heat treat it.

The White Paper listed the part at $0 capital and $ 0.42 each (ref part #17028). The F&G quote was $.55 each, and 24 weeks for production parts.

Remington Arms Co.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/16/00

Re: M/710 Trigger Pt#300435

The white paper was based on the Ilion SAP cost of $1.53 for the M/700 trigger C-15280. We requested the serrations be removed from the trigger bow to get a trigger per Sterling Sintered Quote #2965A for $0.37 each and a capital charge of $15,225 that was not in the white paper budget. This expense should be made and a new tool purchased. The tool has a payback of 8 months and is justified.

Some of the necessary notes are not on the print. This can be followed after the PO is placed.

Remington Arms Co.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/16/00

Re: M/710 lock tumbler (B-300420-A)

The lock tumbler blank 300420 was not available at the time of the estimate, the white paper did not reflect the addition of the tooling, estimated cost $35,000. This tool should be made in Ilion to be consistent in processing with all other safety locks. The development time would be decreased, as well.

If the tool has not been quoted through Ilion, make sure that happens and the tool is ordered ASAP.

83

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/19/00

Re: M/710 Stock Tool

The M/710 stock tool was approved for build on 12/2/99. The tool will be purchased through par 4 with an 18-week lead-time to the completion of the tool. Sam Todd assured me the press time will be available and the lapse between the tool build completion and sampling will be within 2-3 days afterward. The quoted price of $145,300 includes cooling fixtures and texturing from Mold Tech that is equivalent to the M/7 texture sample provide to Par 4 by Todd Cook, from E'town. A $5,625 premium to reduce the lead-time by one week, was not elected.

A 2-station drill fixture with two pneumatic drill heads will be build to de-gate and drill the swivel stud holes. The cost is $7,500 and 4 weeks. The tool can be amortized over the first 20,000 pieces, which will be produced within 12 months of the release of production quantities at price of $0.419 per stock or total stock price of $5.799 each. The price would then return to the normal $5.38 each.

The tool is guaranteed for 250,000 shots on a .001 parting line or less. No guarantee on the texturing.

Memo

To: 710 team

From: Matt Golemboski

CC: Joe Zajk

Date: 01/19/00

Re: M/710 Magazine Latch Tool

The M/710 magazine latch tool was approved for build on 12/2/99. The tool will be purchased through Par 4 with an 16-week lead-time to the completion of the tool. Sam Todd assured me the press time will be available and the lapse between the tool build completion and sampling will be within 2-3 days afterward. Piece price of $0.245 each for 20,000 and $31,806 for the tool. No texturing is required on the part.

No guarantee on the parting lines was given.

As of 12/6/99, Mayfield will quote the part as a Powder Metal part through Sterling Sintered. Joe has overnighted the drawings and specs to look at the possibility of a powder metal part with material the same a the 597 latch for non-heat treated and same as the barrel clamp for heat treated options. This will require Sterling to complete a secondary drill operation. The powder metal option is being pursued in case the plastic latch wears quickly, a concern brought forward by Mike Keeney on 12/6/99.

The Par 4 will be put on hold on 12/13/99 if we do not have a decision from Sterling by this time. Mett will notify Sam Todd of Par 4 to inform him of a potential changes and we will have the PO held until 12/13/99.

Assembly cost of the latch and spring to the stock will be quoted at a later date.