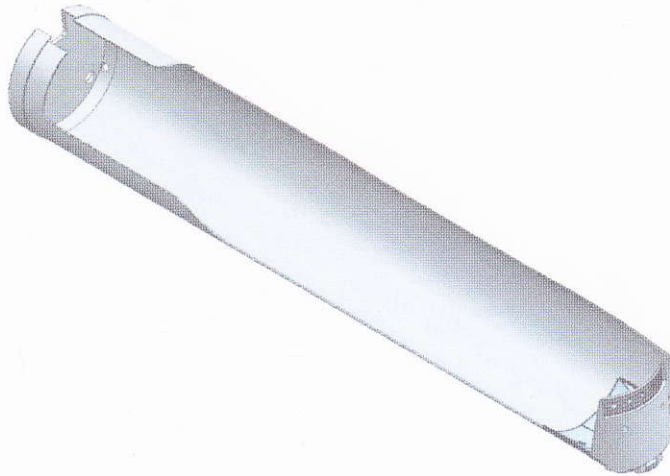


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**155MM/39CAL GUN SYSTEM
"BOFORS"**



**QUALITY ASSURANCE PLAN
OF
LOADING TROUGH (MODIFIED) (IPA-0040)**

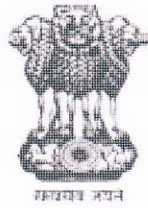
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**QUALITY ASSURANCE PLAN OF
LOADING TROUGH (MODIFIED) (IPA-0040)
FOR
155 mm/39 CAL BOFORS**

इस हैंडबुक के होने से किसी प्रयोक्ता को यह अधिकार नहीं मिलता कि वह कंपोनेंट्स की मरम्मत करे या उसे बदलने का काम करे। अन्य एजेंसियों द्वारा मरम्मत कार्य "परमिसेबल रिपेयर शेड्यूल" के अनुसार किए जाएं जैसा कि ई एम ई आर या उस जैसे मैनुअलों में समय-समय पर प्रकाशित किया गया है।

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**155MM/39CAL GUN SYSTEM
“BOFORS”**

**QUALITY ASSURANCE PLAN
OF
LOADING TROUGH (MODIFIED) (IPA-0040)**


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INTRODUCTION

THE LOADING TROUGH IS A MECHANICAL SUB-ASSY OF RAMMER. ITS SOLO FUNCTIONALITY ASPECT IS TO FEED BMCS CHARGES INTO THE ORDNANCE CHAMBER. IT ALSO SIMULTANEOUSLY EXERTS FORCE TO MOVE SHELL INTO THE CHAMBER BY ITS FRONT-END. HENCE THE RIGIDITY OF THE COLD ROLLED TROUGH TO BE MAINTAINED.

THE MAIN ELEMENTS THAT ARE USED IN ASSEMBLY OF THE LOADING TROUGH ARE RAMMER TOOTH, PLATE, BRACKET, GABLE ETC.


THE CHANCE OF STUCK OFF OF BMCS DURING RAMMING BECOME OFTEN. SO, THE DIMENSIONAL ASPECT & ADDICTIVENESS (TEFLON COATING) OF LOADING TROUGH BECOME VERY CRITICAL AND SHOULD NOT BE COMPROMISE AT ALL.


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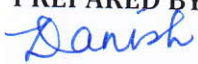
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A. BILL OF MATERIAL

S.No	Nomenclature	Part	Quantity
1.	Rammer Tooth Assy (Modified)	IPA-0041	01
2.	Loading Trough Rammer (Modified)	IPA-0042	01
3.	Plate (Modified)	IPA-0043	01
4.	Bracket (Modified)	IPA-0044	01
5.	Rammer Tooth (Modified)	IPA-0045	01
6.	Gable (Modified)	IRD/155/0019	01
7.	Insert	IPA-0060	01
8.	Adjusting Screw (Left Thread) (M10-6)	6361018	02
9.	Nut	6348598	04
10.	Hexagon Nut	6333451	02
11.	Hex. Socket HD Cap Screw (N2-161-8x35)	10809457	04
12.	Hex. Nut (N3-56-60)	10310930	02

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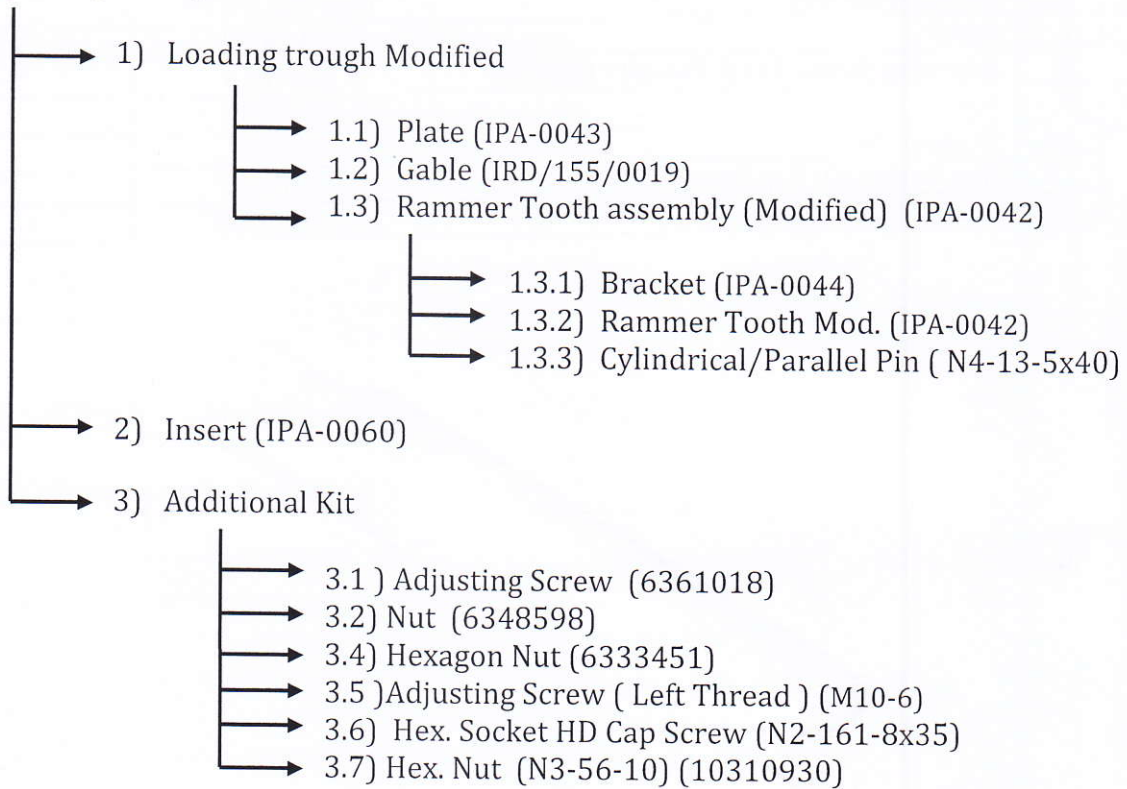


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B. TREE CHART

Loading Trough Complete



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1.0) LOADING TROUGH /RAMMER (MODIFIED) : WELDING AND MACHINING DRAWING (IPA-0042) CONSISTS OF:

S.N	Items	Part No./Drawing no.	Quantity	Inspection
1.1	Plate	IPA-0043	01	<p><u>Assembly dimensions:</u></p> <p>993.5mm 900mm 2mm 15mm Φ181mm Φ161mm 89°52'</p>
1.2	Gable	IRD/155/0019	01	<p>Angularity 0.1 AB & Perpendicularity 0.1 AB</p> <p>42mm 9° 45°</p> <p><u>Detail B:</u></p> <p>0.5X45° Φ154^{-0.1}mm</p>
1.3	Rammer Tooth Assy (Modified)	IPA-0041	01	<p><u>Welding Standard and specification :</u></p> <p>Welding Class- C Welding process- TIG Filler metal-W20-6 Welding specification- A3034</p> <p><u>Ensure during assembly :</u></p> <p>a) Shot Blasting Sa2.5 b) After shot blasting, following processes to be done: i. Degreased with Trichloroethylene Vapor: W8-28. ii. Surface coated with Teflon, W7-39. The</p>

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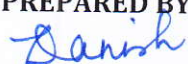
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				<p>methodology of surface coating should be done as per Y4-36-2 (Non-Stick & Self Lubricating treatment) standard.</p> <p>c) After surface treatment, check that the rammer tooth joint does not bind. If necessary, remove the pin and then excess paint removed.</p> <p>d) HT at 420°</p>
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1.1 PLATE (MODIFIED) (IPA-0043)

1.1.1 Raw material: Chemical Compositions & mechanical Properties as per given specification.

Material Standard	Mechanical properties after heat treatment as prescribed in standard.	Inspection
IS: 6911-1992 Grade: X07Cr18Ni9 (Work Hardened) OR IS: 6911-1992 (Re-Affirmed-2004) Steel Grade: X02Cr17Ni12Mo2	For IS:6911-1992 , Grade : X07Cr18Ni9 (Work Hardened) Rm =890 Mpa (min.) Rp 0.2 =590 Mpa (min)	NABL Accredited lab report

1.1.2 Machining processes lay on firm itself as per there capability.

1.1.3 QC-IV (Internal Verification) static inspection: Dimension after machining & bending process:

Dimensions			Inspection tool:
Front View:	Plan	C-C Section	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate. After examine dimensions, Pass gauge in longitudinal direction. Ensure free movement of gauge thought-out the length.
928mm	190mm	6mm	
0.5mm		~R8mm	
786mm	927.5mm	D-D Section	
110mm	90mm	Φ161 ⁻¹ mm	
67mm	A-A Section	E-E Section	
605mm	Φ161 ^{±1} mm	Φ161 ^{±1} mm	
200mm	42mm	80.5°	
260mm	25mm		
68mm	2mm		
284mm	13.5°		
234mm			
38.5mm			
56.5mm			

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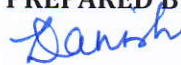
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132mm 457 ⁻¹ mm R15mm (10x) R4mm	B-B Section Φ161 ^{±1} mm (2x) 18mm 67.5°		
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1.2 GABLE (MODIFIED) (IRD/155/0019)

1.2.1 Raw material: Chemical Compositions & mechanical Properties as per given specification.

Material Standard	Inspection
BS:970 Pt-1 :1983 , Grade 303S31	NABL Accredited lab report

1.2.2 Machining processes lay on firm itself as per there capability.

1.2.3 QC-IV (Internal Verification) static inspection: Dimension after machining processes:

Dimensions			Inspection tool:
40mm	B-B Section	Section C-C	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.
42mm			
21mm	26mm	Φ161mm	
20mm	2.5mm	Φ154h9	
PCD Φ128mm	5mm	Φ155.5mm	
Φ10mm	20mm	Φ157 ^{+0.1} mm	
32°	3mm	0.5X45°	
45°	0.5X45°	2°8'51"	
90°(3x)	16H9 (4x) (Position	R0.2mm(max)	
R77.5	,Φ 0.2mm A)		
R5mm			

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1.3) RAMMER TOOTH ASSEMBLY (MODIFIED) (IPA-0041) CONSISTS OF:

S.N	Items	Part No.	Quantity	Inspection
1.3.1	Bracket (Modified)	IPA-0044	01	<u>Assembly dimensions:</u> R5.5mm R6mm 6mm 5.5mm 5°
1.3.2	Rammer Tooth (Modified)	IPA-0045	01	<u>Ensure during assembly :</u> a) Check that the landing is made over the whole extent of radius R5.5 & R6 mm without, Cylindrical Pin (N4-13.5x40), taking any load. Location is mentioned in said drawing. b) Check that the landing is made when joint drilling. At a force F the cylindrical pin N4-13.5x40 shall be without any load.
1.3.3	Cylindrical/ Parallel Pin	N4-13.5X40	01	c) Check that the part IPA-0044 & IPA-0045 from a straight line (180°-1°) up to landing on this surface.

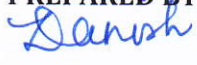
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1.3.1) BRACKET (MODIFIED) (IPA-0044) :**1.3.1.1) Raw material Manufacturing:**


Manufacturing Process	Inspection
Raw material manufacture via Casting Process.	100% X-ray on each item. For Casting Tolerance refer : SS722 GTA13


1.3.1.2) Raw material: Chemical Compositions & mechanical Properties as per given specification.

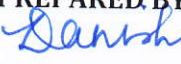
Material Standard	Mechanical properties after heat treatment as prescribed in standard.	Inspection
BS : 3100-76 Grade- 309C32 Or IS:9516-80 Grade- X15Cr24Ni13 Or IS:6911-1992 (Re-Affirmed-2004) Steel grade-X02Cr17Ni12Mo2	For IS:6911-1992 , Grade : X02Cr17Ni12Mo2 Rm =440 Mpa (min.) Rp 0.2 =200 Mpa (min) Hardness:192 HBS	NABL Accredited lab report

1.3.1.3) Machining processes lay on firm itself as per there capability.**1.3.1.4) QC-IV (Internal Verification) static inspection: Dimension after machining processes:**



Dimensions			Inspection tool:
	B-B Section	C-C Section	
18 ^{-0.2} mm			Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.
9mm			
2mm	11mm	Φ8mm (2x)	
40mm	23mm	60°	
66mm	2mm		
R80mm(2x)	45°		
R80.5 ^{-0.5} mm	55°		
5.5mm	5° 15°		

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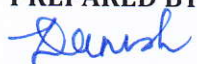
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R80.5 ^{-0.5} mm R5.5 R78.5 ^{-0.05} mm 120mm 40mm Φ5C8 A-A Section Φ8mm (2x) 2mm 30° 45°	3°.30' R2mm 2mm 38mm 14.5mm 44mm R116mm(2x) R3mm (2x)		
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1.3.2) RAMMER TOOTH (MODIFIED) (IPA-0045) :**1.3.2.1) Raw material Manufacturing:**

Manufacturing Process	Inspection
Raw material manufacture via Casting Process.	100% X-ray on each item. For Casting Tolerance refer : SS722 GTA13


1.3.2.2) Raw material: Chemical Compositions & mechanical Properties as per given specification.

Material Standard	Mechanical properties after heat treatment as prescribed in standard.	Inspection
BS : 3100-76 Grade- 309C32 Or IS:9516-80 Grade- X15Cr24Ni13 Or IS:6911-1992 (Re-Affirmed-2004) Steel grade-X02Cr17Ni12Mo2	For IS:6911-1992 , Grade : X02Cr17Ni12Mo2 Rm =440 Mpa (min.) Rp 0.2 =200 Mpa (min) Hardness:192 HBS	NABL Accredited lab report


1.3.2.3) Machining processes lay on firm itself as per there capability.**1.3.2.4) QC-IV (Internal Verification) static inspection: Dimension after machining processes:**

Dimensions			Inspection tool:
107.5 ^{±0.06} mm 37.5mm 11.5mm 5.5mm 5° R80 ^{-0.5} mm 8° Φ5 ^{±0.006} mm drilling should be done at the time of assembly	35mm 24mm 22mm R76° R73 ^{°-0.5°} R80 ^{°-0.5°} C-C Section	D-D Section 27mm 2mm(5x) 5mm(5x) 1.5mm 0.5mm 2.5mm Φ8 mm(5x) R76mm	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.

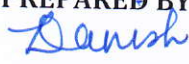
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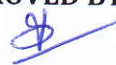

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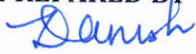
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B-B Section 34.5mm 25mm 12.5mm 23mm 27mm 5mm R80 R80 ^{-0.5} mm R1.5mm R5mm (2x) R6mm 50° 40° 55° 12mm 18 ^{+0.05 to +0.1} mm 12mm 9mm 5.5mm 113mm 45mm R80mm 2 hole for core frame	Φ8mm (2x for core frame) R~10mm 45°	90° E-E Section R11.5mm 15°(4x)	
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1.3.3) Cylindrical /Parallel Pin (N4-13-5x40) : Standard item

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2) INSERT (IPA-0060)

2.1 Raw material: Chemical Compositions & mechanical Properties as per given specification.


Material Standard	Mechanical properties after heat treatment as prescribed in standard.	Inspection
IS:5517-1993 , Design 42Cr4Mo2, LRS 63 Indigenous electrode Specification IS:1395-82, Class E76 BM 311Fe	For IS:5517-1993 , Design 42Cr4Mo2, LRS 63 Tensile strength =900-1050 Mpa 0.2% Proof stress =650 Mpa (min) Elongation 5.65/A : 11% Izod Impact : 50 Joules (min)	NABL Accredited lab report

2.2) Machining processes: As per process schedule


2.3) QC-IV (Internal Verification) static inspection: Dimension after machining processes:

Dimensions	Inspection tool:
25mm, 3x45° 45mm, 7.6mm, 3mm, 3x45° 3x45°	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.

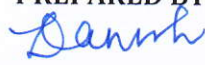
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3) ADDITIONAL ITEMS OF KIT FOR MODIFIED LOADING TROUGH CONSIST OF :

S.N	Items	Standard/ No.	Part	Remarks
3.1	Adjusting Screw	6361018		Regular item
3.2	Nut	6348598		Regular item
3.3	Nut	M10		Standard item of following spec. IS:1367,8.8 to Pt. No. 93-193
3.4	Hexagon Nut	10359188		Standard item
3.5	Adjusting Screw (Left Thread)	M10-6		Standard item
3.6	Hex. Socket HD Cap Screw	(N2-161-8x35)		Standard item
3.7	Hex. Nut	(N3-56-10) 10310930)		Standard item

3.1) ADJUSTING SCREW (6361018)

3.1.1) QC Inspection: Chemical Compositions & mechanical Properties of casted component

Material Standard	Inspection
IS:5517-93 Des 42Cr4Mo2	NABL Accredited lab report


3.1.2) Machining processes lay on firm itself as per there capability.


3.1.3) QC-IV (Internal Verification) static inspection: Dimension after machining processes:

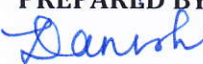
Dimensions	Inspection tool:
67mm 5mm 36mm 33mm M10-6g (Left Thread) Cross section: 12 x 12 mm	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.



3.1.4) Surface treatment:

Surface treatment	Method	Thickness
Zinc Phosphating	With surface oiling	Up to 8 micron

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3.2) NUT (6348598)

3.2.1) Raw material: Chemical Compositions & mechanical Properties as per given specification.

Material Standard	Inspection
IS:5517-93 Des 30Ni13Cr5	NABL Accredited lab report


3.2.2) Machining processes lay on firm itself as per there capability.


3.2.3) QC-IV (Internal Verification) static inspection: Dimension after machining processes:

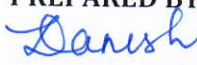
Dimensions		Inspection tool:
27mm 23mm R40mm M8-7H Φ15.8h9 ~5mm	10mm Φ20mm	Use General mechanical instruments for lower tolerance dimensions. Dimensions having tight tolerance may verified by CMM or alternate.

3.2.4) Surface treatment:



Surface treatment	Method	Thickness
Zinc Phosphating	With surface oiling	Up to 8 micron

APPROVED BY

(SANJAY SHRIVASTAVA)
JT.GM/QC

REVIEWED BY

(NILESH SOLANKI)
WM/QC

PREPARED BY

(DANISH ANSARI)
C/M(T)/QC

RESTRICTED

	QUALITY ASSURANCE PLAN OF MODIFIED LOADING TROUGH (IPA-0040): 155MM/39CAL BOFORS GUN	
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LISTS OF STANDARD ITEMS :

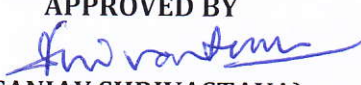
S.N	Nomenclature	Drawing No./Article No	Size /Spec./standard/others details
1.	Cylindrical Pin	NA	N4-13.5X40
2.	Nut	6348598	NA
3.	Hexagon Nut	6333451	NA
4.	Adjusting Screw (Left Thread)	6361018	M10-6
5.	Hex. Socket HD Cap Screw	10809457	N2-161-8x35
6.	Hex. Nut	10310930	N3-56-60

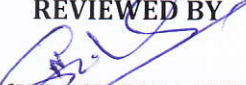
List of Documents to be submitted by firm along with finished component if inspection has to be carried out at factory end:

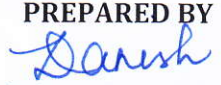
1. Dimensional acceptance check sheet – 100%
2. Heat treatment NABL Accredited/Gov. approved report with specified hardness as mentioned in standard.
3. Chemical composition and mechanical properties NABL accredited/Gov. approved lab reports.
4. Surface treatment report.
5. Teflon Coating conformation certificate.
6. *Test piece of adequate size of plate (modified) (IPA-0043) to be facilitated by firm, to GCF premise for testing its Chemical and mechanical properties, before commencement of machining process.*
7. *Copies of invoice /Purchases order of all raw materials that will be used in manufacturing/machining of loading trough are to be attached herewith this QAP by the firm in hard copy .*

IMPORTANT NOTES:

1. If any query arises pertaining to quality plan, the same may be asked by firm for proper clarification before starting bulk production.
2. This quality plan, after proper vetting by standard cell, should be issued to vendor along with supply order. Vetting by standard cell is to be done for checking whether any modification or amendment of material/drawing has been introduced in drawing within of action of procurement.
3. *If required, loading trough may be chosen from a lot at random basis for complete destructive test of individual items to assure the chemical composition & mechanical properties. If any of individual items of loading trough fail to meet the requirement as per specified in material standard, then whole lot may rejected.*

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RECORDS OF AMENDMENTS

**NAME OF ITEM/RAW MATERIAL/SUB ASSEMBLY: LOADING TROUGH (IPA-0040)
/RAMMER/BOFORS**

CHANGE NOTICE NO.	AMENDMENT NO.	AUTHORITY (INCORPORATED BY NAME AND RANK IN BLOCK LETTER)	INITIAL WITH DATE

