

WEAPONS AND RADIO SYSTEM TUNING GROUP (MUMBAI)



MANUAL FOR SETTING TO WORK AND TESTING TUNING

AK 630



Foreword

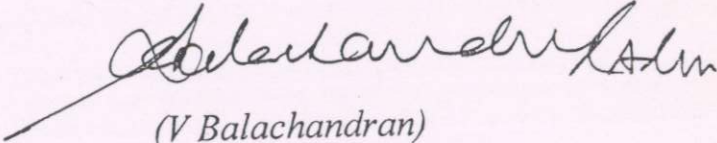
Growing proliferation and threat from Anti-ship missiles to surface combatants at sea needs to be countered by effective Anti-Missile Defence (AMD) capability onboard. AK 630 Gun Mountings fitted onboard many IN ships, are the potent backbone of our AMD capability. Being the final hard kill CIWS, against an incoming missile attack, the mounting has to be maintained in its optimum operational state for accurate engagement.

WRSTG (MB) has been undertaking STW/T&T of these mountings for the past six years and successfully presented 26 mountings till date. However procedures/methodology for various constituent activities are not available in a single document and are spread over various sections of Technical Document (TD) and Operating Instruction (OI). Further, these documents do not take into consideration the fact that increasingly these mountings have been interfaced with Western origin FCS like Shikari/Lynx on newly constructed ships and hence STW procedures to be modified to that extent.

This manual is an attempt to present STW and Testing Tuning procedures for AK 630 mountings in a comprehensive manner. It also incorporates experience gained by WRSTG (MB) over a number of years. The document has been so designed that in addition to STW of newly installed mountings, it can also be used for undertaking parameter adjustments, tuning and defect rectification of mountings.

It must however be borne in mind that this manual is only a guide and by no means a substitute for system documents. The users may propose necessary amendments to ensure continuous updation of this manual by WRSTG (MB).

Mumbai
17 Nov 05


(V Balachandran)
Rear Admiral
Chief Staff Officer (Technical)
Headquarters
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RECORD OF AMENDMENTS

Amendment No. and Date	Authority	Remarks	Embodied by (Name, Rank and Designation)	Signature

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MANUAL FOR SETTING TO WORK AND TESTING TUNING OF AK 630 GUN MOUNTINGS

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RUSSIAN ALPHABETS

Print Letters	Name of the Letters	Sounds Denoted in the Examples
А а	a	a-as in "park"
Б б	be	b-as in but
В в	ve	v- as in virtue
Г г	ge	g- as in great
Д д	de	d as in Delhi
Е е	je	je (ye) as in yet
Ё ё	jo	jo (yo)- as in yoke
Ж ж	zhe	close to su in measure
З з	ze	z- as in zone
И и	i(ee)	i-as in visa
Й й	y	y-as in may or boy
К к	ka	k-as in keep
Л л	el	l-as in lamp
М м	em	m-as in map
Н н	en	n-as in not
О о	o	o-as in object
П п	pe	p-as in pen
Р р	er	r-as in run
С с	es	s -as in sun
Т т	te	t-as in talisman but apical
У у	u	u- as in rule
Ф ф	ef	f- as in fun
Х х	(k) ha	h - as in hut
Ц ц	tse	ts-as in cats or vats
Ч ч	ch'e(chhe)	close to ch in chat
Ш ш	sa(sh)	close to sh in shop but always hard.
Щ щ	sa(shch)	close to shya in shyam, but always soft.
Э э	e	e- as in ever
Ю ю	ju(yu)	very close to word you
Я я	ja(ya)	Ja (ya)- as in yard

CHAPTER I

Introduction

0101. **Background.** Weapon and Radio Systems Tuning Group was set up in 1974 to undertake Setting to Work (STW) and Testing & Tuning (TT) of Leander class equipment. STW/TT of AK 630 Gun Mountings is a core competence area of the unit, encompassing successful trials of thirty mountings onboard IN ships Mysore, Prahar, Taragiri, Mumbai, Kirch, Prabal, Betwa, Pralay, Kulish, Karmukh and Beas.

0102. **Need for STW/TT Manual.** A concerted attempt to generate a single comprehensive document was considered necessary for the following reasons:-

- (a) Presently available Russian origin documentation covering STW/TT procedures and constituent activities are spread over various classified Technical Descriptions (TD), Operating Instructions (OI) and Album of Drawings.
- (b) Existing documentation and procedures relate to associated MR-123/Vymple FCS and does not cater for new induction Lynx/Shikari FCS.
- (c) STW/TT procedures presently adopted are not benchmarked with corresponding specific HATs test/standard to check ideal mounting performance.
- (d) Specific and structured training on STW/TT aspects are not adequately covered during training / PCT. The fine-tuning / parameter adjustment of a sub-optimally operational AK 630 is an assiduous and dexterous task which requires a systematic approach.

0103. **Aim.** The manual aims to provide a holistic view of STW/TT pre-requisites, checks and procedures to be adopted for achieving optimal AK 630 performance onboard. This document provides a basis for WMO/ALO(GG)/EAP to assess current state of AK 630 mounting(s) and undertake effective fine-tuning aided by pictorial depictions of relevant panel/indication co-related with applicable HATs test. It must however be borne in mind that this manual is only a guide and not a substitute for system documents.

0104. **Benefits of STW/TT Manual.** Following benefits may be accrued by ships/establishments by adopting procedures explained in the STW/TT manual:-

(a) **Operational Ships** For operational mountings, fine-tuning and parameter adjustment requiring approximately 26 man-days may be undertaken in accordance with Chapter IV (STW/TT) and Chapter V (Parameter Adjustments and Checks).

(b) **Ships under Refit** Prior completion of prolonged refit, Initial Checks (Chapter III), STW/TT (Chapter IV) and Parameter Adjustments (Chapter V) may be carried out.

(c) **New Construction Ships** Pre-requisites for commencing STW/TT as listed at Chapter II (Pre-requisites for STW/TT) may be ensured by WOT for timely completion of acceptance trials.

(d) **Naval Dockyards / FMU** Updating AK 630 STW/TT procedures vis-à-vis new induction associated FCS Lynx / Shikari.

(e) **Training Establishments** As an training aid for specific sessions on AK 630 STW/TT procedures during equipment training / PCT.

(f) **Ordnance Factory Board** Finalising requirement of tools, T & T spares and documentation for STW/TT of indigenously manufactured (ToT) AK 630 gun mountings.

0105. **STW/TT - Process Overview.** Brief stage-wise description of the entire STW/TT and Trial activities undertaken for an AK 630 mounting installed onboard a new construction ship is tabulated at Appendix A for information.

0106. **System Configuration.** Block diagram of AK 630 with Vympel / MR 123 and Lynx / Shikari configurations is pictorially depicted at Appendix B and C respectively.

CHAPTER 2

Prerequisites for STW/TT

0201. **Introduction.** STW/TT is required to be undertaken if any of the following symptoms are observed during operation or inspection of the mounting during maintenance: -

- (a) Mounting is not operating smoothly i.e. jerky motion, hunting or slow response during follow up from ODS / Kolanka sight / FCR.
- (b) Mounting requires more than two and half oscillations to settle down.
- (c) Mounting does not come to the securing position after switching off RC from ACP/ΠΥAPT (as applicable).
- (d) Mounting does not go to locking position / get locked after switching off drives from ACP/ΠΥAPT (as applicable).
- (e) Static and Dynamic errors measured at CY using milli-voltmeter are more than values specified at Para 0503 (Table B).
- (f) The light Beam Indicator of Relay unit in CY panel does not coincide with the zero-notch marking on the dial.
- (g) Post replacement of major units like Amplifier Unit, Relay Unit or Switching Unit.
- (h) Post major repairs of any of the drives.
- (j) Post major overhauling of mountings during refit.

0202. **Test Equipments and Tools.** Test equipment and tools used for STW/TT are as follows: -

- (a) Megger 100V
- (b) Megger 500V

- (c) Multimeter
- (d) Milli-voltmeter B3-55
- (e) List of SPTA items / important spares generally consumed during STW/TT of AK 630 is placed at Appendix -D.
- (f) Tool Kit Bag in SPTA box of AK 630
- (g) Soldering Iron 220V, 75W

0203. **Documents.** Documentation referred during STW/TT is as follows:-

- (a) Operating Instructions (OI) and Technical Description (TD) of AK 630
- (b) Album of Drawings for AK 630
- (c) Service Log
- (d) Cable Schedule
- (e) Approved Polar Diagram / Firing Arc and Danger Zone

0204. **Prerequisites for STW.** Prerequisites for commencing mounting STW/TT onboard new construction ships are as follows: -

- (a) Complete cabling and connectorisation of AK 630 devices and associated units supplied by BEL (LCP, ACP and ODS)!
- (b) Completion of Installation Inspection (IIs) of associated compartments.
- (c) Availability of Main (stabilized) power supplies (380V, 50Hz, 3 Φ and 220V, 400Hz, 1 Φ).
- (d) Effective AC in associated compartments with recommended temperature not more than 25° C.
- (e) Internal communication in associated compartments.
- (f) AK 630 air bottles charged up to 150 Kg/cm² pressure.

- (g) Adequate fresh water level in the cooling tank of AK 630.
- (h) Adequate level of OM -15 oil in the hydraulic tanks of AK 630 drives.
- (g) Mounting barbets free from any physical obstructions due to loose cables, unsecured hoses or tools.
- (h) Series inspection of automatic gun AO -18 by NAD.
- (j) Sample Test of hydraulic oil OM - 15 by NMRL.

CHAPTER III

Initial Checks

0301. **Introduction.** The mounting has to be thoroughly inspected and checked for any physical obstructions from loose cables, unsecured hoses or tools, prior energizing.

0302. **Visual inspection.** The mounting and associated sub-systems / devices are to be visually inspected for the following: -

- (a) Damage to components and units.
- (b) Cracks and corrosion in pipe joints.
- (c) Condition of rubber gaskets.
- (d) Cable sleeves.
- (e) Cleanliness of hydraulic filters in training and elevation drives.
- (f) Mounting greasing and painting.
- (g) Training and elevation motion of the mounting for smooth operation by manual operation.
- (h) Working condition of training and elevation buffers.
- (i) Proper locking / securing of Cupola cover.

0303. **Check wire.** System cables are to be checked for proper connectivity and continuity as per cable schedule. In addition, metal tallies need to be secured on cables with markings as per check wire schedule provided by OEM. The cable details are as follows: -

- (a) 45 nos. cables from 5Y (Control Unit) to mounting.
- (b) Two nos. cables from Local Control Panel (LCP) / 45-30 to CY (Control Station) / 5Y (Control Unit).

(c) Two nos. cables from Optical Director System (ODS) / Kolanka Sight to ACP/ LCP.

0304. **Insulation.** The insulation for all cables and devices needs to be measured as explained below:-

(a) **Cable Insulation.** The insulation of each core as per cable schedule needs to be checked after disconnecting relevant \sqcup connector(s) from units. The insulation resistance between separated electric circuits and the frame should be $>20 \text{ M}\Omega$.

(b) **Device Insulation.** Ensure all sub-systems are de-energized prior commencement of device insulation measurement. The winding insulation for the following units / devices (as per Appendix 10 of Document TD / OI of AK 630) needs to be checked. The insulation resistance $>1 \text{ M}\Omega$. List of insulation points for the following devices are tabulated at Appendix – E: -

- (i) Training Motor, Training Tacho Generator (TG), Training Electro Magnet (EM), Training Angle Limiter, Training Lock.
- (ii) Elevation Motor, Elevation Tacho Generator (TG), Elevation Electro Magnet (EM), Elevation Angle Limiter.
- (iii) Electro Pneumatic valves ЭК 1, ЭК 2, ЭК 3, ЭК 4 & ЭК 5.
- (iv) Gas Ignition Mechanism КП 1, КП 2 and КП 3.
- (v) Firing Circuit Contactor
- (vi) Cooling Sensor
- (vii) Round Counter Sensor
- (h) Cooling Pump Motor

0305. **Pneumatic System.** The pneumatic system needs to be checked for leakage and correct pressure as specified below: -

a) Air Leakage Checks.

- (i) Leakage from air bottle.
- (ii) At all pneumatic pipe joints inside the mounting and barbette.
- (iii) At Pneumatic Puller and Feeder Mechanism inside the mounting.
- (iv) Electro-pneumatic valves ЭК by manual operation.

(b) Air Pressure Checks.

- (i) Air bottle pressure = 280 Kgf/cm².
- (ii) The air pressure after the first reducer = 150 Kgf/cm².
- (iii) The air pressure after the second reducer = 65 to 74 Kgf/cm².

(c) Pneumatic System Checks. Prior commencement of Pneumatic System checks, the following precautions needs to be taken: -

- (i) Ensure that the mounting is de-energized.
- (ii) Ensure that the automatic gun AO-18 is unloaded.
- (iii) Ensure the Cartridge Belt is removed from the feed-ways to the magazine beyond the Pneumatic Puller.
- (iv) Check the Pneumatic pressure in the mounting after opening the main feeding valve of AK 630 air cylinder. The pressure should be between 65 to 74 Kgf/cm².

(d) Pneumatic Puller Checks Pneumatic puller checks are to undertaken as follows: -

- (i) Ensure the Pneumatic puller is free from damage by checking externally.
- (ii) Ensure that no round is present in the feeding chute.

(iii) Check the sprocket for free movement by passing a dummy cartridge rounds through feeding tray. The dummy cartridge round should pass through the sprocket freely.

(iv) While operating ЭК – 5 manually, the free rotation of the sprocket needs to be checked.

(e) Feeder Mechanism Checks.

(i) Prepare cartridge belt with dummy shells.

(ii) Load the Dummy shell belt and check for smooth loading of the cartridge belt in the feeding chute.

0306. Hydraulic System. The oil level in the hydraulic tanks of the training and elevation drives need to be checked. It should be above the lower marking on the tank glass cover and a thorough check for any leaks in the system is to be carried out.

0307. Power Supplies. The availability of following power supplies are to be checked: -

(a) Check availability of $380V \pm 5\%$, 50 ± 1.5 Hz, and 3Φ in both alternate and normal mode from Auto-change over switch (ACOS).

(b) Check the availability of $380 V \pm 19 V$, 50 ± 1.5 Hz, 3Φ as input voltage to the rectifier.

(c) Check the availability of $27V \pm 2.7V$ DC from the rectifier output.

(d) Switch on LCP and check for the following voltages at U_{11} of control station CY :-

(i) The availability of $220 \pm 11 V$, 400 ± 12 Hz, 1Φ between Pin 20 and 22.

(ii) The availability of $36 \pm 1.8 V$, 400 ± 12 Hz, 1Φ between Pin 23 and 25.

0308. **Internal Communication.** Internal communication amongst the following compartments associated with AK 630 needs to be checked:-

- (a) Equipment Rooms
- (b) LCP Compartment/ GDR (as applicable)
- (c) Barbettes
- (d) ACP Compartment
- (e) ODS / Kolanka Sight (as applicable)

0309. **Cooling System.** The cooling system checks for the mounting are as follows: -

- (a) The shaft of the pump motor to be rotated by hand and should be free to rotate without any unusual sound.
- (b) Condition of the cooling tank for proper cleaning and application of paint.
- (c) The level of the water in the cooling tank should be between the two lines marked on the glass window of the cooling tank.
- (d) Water Leakages from the hoses.
- (e) Switch on cooling pump from LCP Panel.
- (f) Cooling signal lamp indication available at LCP.
- (g) Visually check that approx. 60 - 100 drops / minute, which is permissible, may pass through oil seals of pump during operation.

0310. **Smooth Operation.** Operate the mounting manually in training and elevation from limit to limit. It should move smoothly without any obstruction. For manual operation of mounting, ensure that training and elevation drive valve box(es) are in horizontal (manual) position. Subsequently, rotate the cluster with the help of a handle to check free movement.

0311. **Rigid Stopper.** Move the mounting manually from limit to limit in both training and elevation. Note the training and elevation values from the dials in the barbette. These readings should match with the polar diagram. If the values are outside the limits mentioned in polar diagram, rigid stoppers are to be re-located. Repeat above procedure till the values specified in the polar diagram are achieved.

0312. **Firing Arc.** The firing arcs are specified in the Service Log/ Polar diagram. Checks are to be carried out as per the procedure below: -

(a) **Training.** Connect Avometer to pins 2 and 4 of $\text{U}46$ in the mounting. Move the mounting in training to port limit. Note down the values of training dial in the barbette when the firing circuit breaks, which is indicated by loss of continuity in the Avometer. Now bring back the mounting and note down the training value when the firing circuit is restored which is indicated by regaining the continuity in the Avometer. Repeat this procedure on the starboard side also.

(b) **Elevation.** Connect Avometer to pins 2 and 4 of $\text{U}46$ in the mounting, move the mounting to elevation limit. Note down the values of elevation dial in the barbette when the firing circuit breaks, which is indicated by loss of continuity in the Avometer. Now bring back the mounting and note down the elevation value when the firing circuit is restored is indicated by regaining the continuity in the Avometer. Repeat this procedure on the depression side also.

(c) **Firing Circuit Checks.** The firing circuit needs to be checked for seizing of firing of the mounting when not in firing zone and operation of firing circuit when in firing zone. This could be checked after tuning/adjusting the mismatch error as explained in Para 0407 of Chapter IV. Precautions and procedure for firing circuit checks are enumerated at Para 0508 of Chapter V.

0313. **Braking Angles.** To prevent overshooting or hitting the rigid stops, the mounting should stop before approaching the rigid stops. The same is to be checked by the procedure given below: -

(a) **Training.** Connect Avometer to pins 1 & 2 of $\text{U}42$ in the mounting. Move the mounting manually in training to port limit. Note down the value of training dial in the barbette. When the braking circuit

makes, it is indicated by regaining continuity in the Avometer. Now bring back the mounting and note down the training value. When the braking circuit breaks, it is indicated by loss of continuity in the Avometer. Repeat this procedure on the starboard side by connecting the Avometer to pins 1 & 3 of Щ 42.

(b) Elevation. Connect Avometer to pins 1 & 2 of Щ 41 in the mounting, move the mounting to elevation limit. Note down the value of elevation dial in the barrette. When the braking circuit makes, it is indicated by continuity in the Avometer. Now bring back the mounting and note down the elevation value. When the braking circuit breaks, it is indicated by loss of continuity in the Avometer. Repeat this procedure on the depression side by connecting the Avometer to pins 1 & 3 of Щ 41.

0314. Switching On. For switching on the mounting, the following procedure needs to be adopted: -

- (a) Switch on the rectifier and check output = 27V DC.
- (b) Switch on LCP/ ПУАРТ and check that all indication lamps are glowing.
- (c) Switch on cooling pump. Check for any leakage and the direction of rotation as indicated on the pump. Cooling indication on 4Б-30 should come on the LCP/ ПУАРТ.

0315. Out put Voltages of LCP/ ПУАРТ. The output voltage of the LCP/ ПУАРТ needs to be checked after energizing the mounting. The procedure is as follows: -

- (a) Switch on LCP/ ПУАРТ.
- (b) Disconnect Щ1 from СУ.
- (c) Check for following voltages by setting different angles on LCP/4Б-30:-

TEA (in degree)	Pin	Voltage
0°	1, 2	0V
	3, 5	11.88V
45°	1, 2	8.4V
	3, 5	8.4V
90°	1, 2	11.88V
	3, 5	0V

TTA (in degree)	Pin	Voltage
0°	11, 13	0V
	15, 17	11.88V
45°	11, 13	8.4V
	15, 17	8.4V
90°	11, 13	11.88V
	15, 17	0V

(d) Check availability of 220V, 400Hz between pin 20 and 22 of Ω_1 .

(e) Check availability of 36V, 400Hz between pin 23 and 25 of Ω_1 .

(f) TTA and TEA Rates. By varying training and elevation angles at LCP/45-30, check for variation in voltage between pins 19 & 21 for training and pin 7 & 9 for elevation.

CHAPTER IV

Setting to Work and Testing / Tuning

0401. **Introduction.** STW / TT include the following adjustments / checks:-

(a) **CY (Control Station).** Adjustments for locking / unlocking from LCP / ПYAPT, Securing position checks from LCP/ ПYAPT, Laying drives follow up from LCP / 45-30, Firing circuits / FC readiness checks, Braking adjustment and accuracy checks for mismatch error.

(b) **ODS / Mounting / LCP.** Pneumatic starter and gas ignition mechanism checks, De-acceleration angle and electrical braking checks of the mounting, Mounting follow-up in training and elevation, Firing circuit checks from LCP / ПYAPT with dummy cartridge for firing contactor operation, Danger zone and firing circuit operation with ODS / Kolanka sight.

0402. **Matching Transmitter with Receiver Rotary Transformers.** The transmitter and receiver rotary transformers need to be matched to avoid inaccurate follow-up of the mounting. The procedure is as follows:-

(a) Switch on LCP / ПYAPT.

(b) Check for the availability of 220V 400 Hz 1 Φ and 27 V DC supplies.

(c) Ensure 380V, 50 Hz, 3 Φ supply for drives is not switched on, so as to prevent electrical operation of mounting.

(d) For matching transmitter and receiving rotary transformers in training and elevation, the procedure is as follows:-

(i) Training.

(aa) Set training angle to 90° on the LCP / 45 -30

(bb) Train the mounting manually to 1500 mils (stbd) or 4500 mils (port).

(cc) Connect milli-voltmeter B3 - 55 to U_5 of CY.

(dd) Measure the error voltage using milli-voltmeter.

(ee) If the measured error voltage is not below 10 mV, then rack the stator of the receiver.

(ff) Switch on 380V, 50 Hz, 3 Φ supply for drives by selecting 'DRIVE ON' at LCP / 45-30. If the mounting do not move in any direction, then lock the stator of receiver.

(gg) If the mounting starts moving, it implies that the mounting is out of phase by 180°. Switch off the drives supply and lock the stator after turning the stator of receiver by 180°.

(ii) Elevation.

(aa) Set elevation angle to 45° on the LCP / 45-30

(bb) Elevate the mounting to 45° manually using the handle.

(cc) Connect milli-voltmeter B3-55 to U_5 of CY.

(dd) Measure the error voltage on milli-voltmeter B3-55.

(ee) If the measured error voltage is not below 10 mV, then rack the stator of the receiver to bring the error voltage to below 10 mV.

(ff) Switch on 380V, 50 Hz, 3 Φ supply for drives by selecting 'DRIVE ON' at LCP / 45-30. If the mounting does not elevate/depress then lock the stator of the receiver.

(gg) If the mounting begins to move, it implies that the mounting is out of phase by 180°. Switch off drives and lock the stator after turning the stator of receiver/transmitter (as applicable) through 180°.

0403. **Matching Zero Sending Unit.** When the DRIVES or RC switch is selected to OFF position on LCP / ACP / ПУАРТ (as applicable) the gun should automatically come to the securing position and get locked. STW procedure for adjusting the same is given below: -

(a) Training.

(i) Ensure LCP / ПУАРТ is ON and check the availability of 220V, 400Hz, 1 Φ and 27 V DC supplies.

(ii) Ensure that 380V, 50 Hz, 3 Φ supply for drives is not switched on, so as to prevent electrical operation of mounting.

(iii) Lock the mounting manually in elevation as per locking position indicated in the system log book.

(iv) Connect milli-voltmeter B3-55 to Ω 5 of CY.

(v) Measure the error voltage for training.

(vi) The error voltage should be below 10 mV. If not, turn the rotor of traverse zero transmitter in CY Switching Unit (SU / БК). This potentiometer is marked as LC and may be used for zeroising until error voltage is below 10 mV. Refer Appendix F for pictorial depiction of Switching Unit (SU / БК).

(vii) Switch on 380v, 50Hz, 3 Φ supply.

(viii) Switch on the drives and check mounting movement in training as per following procedure: -

(aa) If the mounting does not move in training, then lock the traverse zero transmitter in the Switching Unit.

(bb) If the mounting starts moving in training, it means that zeroing is 180° out of phase. Hence, the stator of training zero transmitter in Switching Unit of CY unit needs to be turned by an angle of 180°. Thereafter, check that error voltage < 10 mV using milli voltmeter and lock the stator.

(b) Elevation.

- (i) Ensure LCP / ПУАРТ is on and check that the supplies 220V, 400Hz, 1 Φ and 27V DC are available.
- (ii) Ensure the supply 380V, 50 Hz, 3 Φ for drives is not switched on, so as to prevent electrical operation of mounting.
- (iii) Lock the mounting manually in training as per locking position indicated in the System Log
- (iv) Connect milli-voltmeter B3-55 to Ω 5 of CY.
- (v) Measure the error voltage for elevation.
- (vi) The error voltage should be below 10 mV. This potentiometer is marked as LC and used for zeroising until error voltage is below 10 mV. Refer Appendix F for pictorial depiction of Switching Unit (SU/БК).
- (vii) Switch on 380v, 50Hz, 3 Φ supply.
- (viii) Switch on the drives and check mounting movement in elevation as per following procedure: -
 - (aa) If the mounting does not move in elevation, then lock the elevation zero transmitter in the Switching Unit.
 - (bb) If the mounting starts moving in elevation, it means that the zeroing has been done at 180° out of phase. Hence the stator of elevation zero transmitter in CY Switching Unit needs to be turned by an angle of 180°. Thereafter, check that error voltage < 10 mV using milli voltmeter and lock the stator.

0404. **Tuning in LC mode** The LC mode of operation corresponds to connecting the mounting to the zero transmitter for securing / locking position adjustment. The switches and potentiometers used in LC mode of operation for tuning are pictorially depicted at Appendix G. The tuning procedure is as follows:-

(a) Training.

(i) Disconnect \mathbb{L} 25 in 5Y (Control Unit). \mathbb{L} 26 should be connected during this procedure.

(ii) All supplies, including drive supply, needs to be switched on from LCP / ПУАРТ.

(iii) The potentiometers RTG & RT (in CY unit) of LC training should be in minimum position.

(iv) Adjust RT training potentiometer so that mounting starts oscillating.

(v) Fine tune RTG potentiometer to seize oscillations.

(vi) Set selector knob B1 of Relay unit on CY to traverse and selector switch B3 to RTG. Introduce mismatch by pressing spring-loaded switch B2 in either direction. Reduce the amplitude of the oscillations with the help of TTG (training) potentiometer in Switching Unit of CY. Minimize the number of oscillations to less than two and half by adjusting RT and RTG potentiometers on Switching Unit of CY panel.

(vii) Measure the error voltage using milli-volt meter. If the error voltage is ≥ 72 mV, adjust the 'Balance' potentiometer on Switching Unit of CY to reduce the error.

(viii) Switch off the drives and check whether mounting is in locking position / locked.

(ix) If the mounting does not get locked, bring it to locking position with the help of LC potentiometer.

(b) Elevation.

(i) Disconnect \mathbb{L} 26 in 5Y (Control Unit). \mathbb{L} 25 should be connected during this procedure.

(ii) All supplies including drive supply needs to be switched on from LCP / ПУАРТ.

- (iii) The potentiometers RTG & RT of LC elevation in unit CY should be in minimum position.
- (iv) Adjust RT elevation potentiometer so that mounting starts oscillating.
- (v) Fine tune RTG elevation potentiometer to seize oscillations.
- (vi) Set selector knob B1 of Relay unit on CY to elevation and selector switch B3 to RTG. Introduce mismatch by pressing spring-loaded switch B2 in either direction. Reduce the amplitude of the oscillations with the help of TTG (elevation) potentiometer in Switching Unit of CY panel. Minimize the number of oscillations to less than two and half by adjusting RT and RTG potentiometers on Switching Unit of CY panel.
- (vii) Measure the error voltage using milli-volt meter. If the error voltage is ≥ 72 mV, adjust the 'Balance' potentiometer on Switching Unit of CY to reduce the error.
- (viii) Switch off the drives and check whether mounting is in locking position / locked.
- (ix) If mounting does not get locked, bring it to locking position with the help of LC potentiometer.

0405. **Tuning in RC mode.** The RC mode of operation corresponds to disconnecting the mounting from zero transmitters and connecting to Radar / Sight mode transmitter for the remote operation. The potentiometers used for tuning in RC mode of operation are pictorially depicted at Appendix F and H. The procedure for tuning in RC mode is as follows: -

(a) Training.

- (i) Disconnect Ω 25 in 5Y unit. Ω 26 should be connected during the procedure.
- (ii) Milli-voltmeter is to be connected to Ω 5 of CY.
- (iii) All supplies, including drive supply, for the mounting needs to be switched on from LCP / ПУАРТ.

(iv) Set command angle of approx. 5° in Elevation from LCP / ПYAPT. The mounting should be near the locking position.

(v) Switch on RC from LCP / ПYAPT. Set command angle in training = 90° .

(vi) Set TTG, RT and RTG potentiometers of RC section to minimum position on CY unit.

(vii) With the help of RT potentiometer in RC mode, bring the mounting to commanded angle in training. If the mounting moves away from commanded angle, bring it back to training = 90° with the help of RTG potentiometer in RC mode.

(viii) Check the static error voltage using milli voltmeter. Adjust static error voltage to less than 72 mV with the help of 'Balance' potentiometer.

(ix) Minimize the voltage oscillations, if any, in the static error with the help of 'Vibration' potentiometer in Amplifier unit of CY as depicted at Appendix H.

(x) Move the mounting from limit to limit in training. If the dynamic error voltage is ≥ 150 mV, adjust the TTG potentiometer to minimize the dynamic error. Confirm that mounting follow-up is smooth.

(b) Elevation.

(i) Disconnect Ω 26 in BY unit. Ω 25 should be connected during the procedure.

(ii) Milli-voltmeter is to be connected to Ω 5 of CY.

(iii) All supplies, including drive supply, for the mounting needs to be switched on from LCP / ПYAPT.

(iv) Set command angle in elevation = 45° from LCP / ПYAPT.

(v) Switch on RC from LCP / ПYAPT.

(vi) Set TTG, RT and RTG potentiometers of RC section to minimum position on unit CY.

(vii) With the help of RT potentiometer in RC mode, bring the mounting to commanded angle in elevation. If the mounting moves away from commanded angle, bring it back to elevation = 45° with the help of RTG potentiometer in RC mode.

(viii) Check the static error voltage using milli voltmeter. Adjust static error voltage to less than 72 mV with the help of 'Balance' potentiometer.

(ix) Minimize the voltage oscillations, if any, in the static error with the help of 'Vibration' potentiometer in Amplifier unit of CY as depicted at Appendix H.

(x) Move the mounting from limit to limit in elevation. If the dynamic error voltage is ≥ 150 mV, adjust the TTG potentiometer to minimize the dynamic error. Confirm that mounting follow-up is smooth.

0406. **Tuning in Braking Mode.** To prevent overshooting or striking the rigid stops, the mounting should decelerate before approaching the rigid stops. The mounting motion needs to be adjusted to apply (electrical) braking before approaching the rigid stops. During change over from Braking mode to RC mode, some vibration may occur in the gun mount. These vibrations do not effect the operation of gun mount in the operating zone. The procedure for the adjustment is given below:-

(a) Training.

(i) Connect one end of the braking cable (cable with spring-loaded toggle switch of milli voltmeter) to TH of milli voltmeter as shown at Appendix J.

(ii) The other end of the braking cable is to be connected to U45 on CY.

(iii) Ensure all supplies, including drive supply, are switched on from LCP / ПУАПТ. The RC switch is kept in off position.

(iv) Set a training angle = 90° from LCP / 45-30.

(v) Turn the shaft of resistor 'RTG Braking' (training) clockwise by 30°- 40° in the Switching Unit of CY.

(vi) Simultaneously, switch on RC from LCP / ПУАРТ with ГН (Command Braking) connected to control station. Braking is switched on by changing over to position 1 (ГН) on the braking cable of milli voltmeter.

(vii) Reading on milli voltmeter should be less than 1.5 V. Otherwise, turn the Balance Braking 1 and 2 (training potentiometers) on CY in clockwise / counter clockwise to achieve voltage reading $\leq 1.5V$ on milli voltmeter.

(viii) If the mounting oscillates, turn the shaft of resistor RTG braking (training) on Switching Unit of CY in counter clockwise direction to eliminate the oscillations.

(b) Elevation.

(i) Connect one end of the braking cable (cable with spring-loaded toggle switch of milli voltmeter) to BH of milli voltmeter as shown at Appendix J.

(ii) The other end of the braking cable is to be connected to Ц15 on CY.

(iii) Ensure all supplies, including drive supply, are switched on from LCP / ПУАРТ. The RC switch is kept in off position.

(iv) Set an elevation angle = 45° from LCP / 4Б-30.

(v) Turn the shaft of resistor 'RTG Braking' (elevation) clockwise by 30°- 40° in the Switching Unit of CY.

(vi) Simultaneously, switch on RC from LCP / ПУАРТ with BH (Command Braking) connected to control station. Braking is switched on by changing over to position 2 (BH) on the braking cable of milli voltmeter.

(vii) Reading on milli voltmeter should be less than 1.5 V. Otherwise, turn the Balance Braking 1 and 2 (elevation potentiometers) on CY in clockwise / counter clockwise to achieve voltage reading $\leq 1.5V$ on milli voltmeter.

(viii) If the mounting oscillates, turn the shaft of resistor RTG braking (elevation) on Switching Unit of CY in counter clockwise direction to eliminate the oscillations.

0407. **Mismatch Adjustment.** The maximum error relay is also referred to as the mismatch error relay. The permissible error between mounting and FCR / Sight is 8 - 16 mils in both training and elevation, beyond which the FC is interrupted. The potentiometers used for mismatch adjustment are pictorially depicted at Appendix G. The procedure for mismatch adjustment is as follows:-

(a) Training.

- (i) Ensure all supplies are switched on from LCP / ПYAPT except 380V, 50Hz, 3 Φ supply for the drive motors.
- (ii) Switch on GMP and RC from LCP / ПYAPT panel.
- (iii) Set a training angle = 45° at LCP / 4Б-30.
- (iv) Train the mounting manually to 750 mils and check reading in training from the Barbette.
- (v) Mismatch lamp should not come on / indicate on the LCP / ПYAPT.
- (vi) If mismatch lamp is on / indicating, then tune the training potentiometer RC at Relay Unit of CY, to eliminate the mismatch lamp indication.
- (vii) Train the mounting slowly and record reading at which the mismatch lamp indicates again on the LCP/ ПYAPT. The mismatch lamp should indicate when mounting training angle is 12 ± 4 mils from the set training angle (750 mils). If tolerance is $> 12 \pm 4$ mils, repeat step (vi) above.

(b) Elevation.

- (i) Ensure all supplies are switched on from LCP / ПYAPT except 380V, 50Hz, 3 Φ supply for the drive motors.
- (ii) Switch on GMP and RC from LCP / ПYAPT panel.

- (iii) Set an elevation angle = 45° at LCP / 4B-30.
- (iv) Elevate the mounting manually to 750 mils and check reading in elevation from the Barbette.
- (v) Mismatch lamp should not come on / indicate on the LCP / ПУАРТ.
- (vi) If mismatch lamp is on / indicating, then tune the elevation potentiometer RC at Relay Unit of CY, to eliminate the mismatch lamp indication.
- (vii) Elevate the mounting slowly and record reading at which the mismatch lamp indicates again on LCP / ПУАРТ. The mismatch lamp should indicate when mounting elevation angle is 12 ± 4 mils from the set elevation angle (750 mils). If tolerance is $> 12 \pm 4$ mils, repeat step (vi) above.

0408. **Speed Follow up Checks.** The procedure for speed follow up checks in training and elevation are enumerated below: -

(a) Training.

- (i) Connect cable of milli-voltmeter to Ш 5 of CY.
- (ii) Set the knob of milli-voltmeter to 30 V.
- (iii) Switch on all supplies from LCP / ПУАРТ except drives and RC.
- (iv) Set training angle = 70° from LCP / 4B-30.
- (v) Switch on drives from LCP / ПУАРТ.
- (vi) Switch on RC and simultaneously measure the readings on the milli-voltmeter. It should be minimum 10V. Otherwise, adjust the TTG training potentiometer for obtaining voltage $> 10V$.

(b) Elevation.

- (i) Connect cable of milli-voltmeter to Ш 5 of CY.

- (ii) Set the knob of milli-voltmeter to 30V.
- (iii) Switch on all supplies on LCP / ПYAPT except drives and RC.
- (iv) Set elevation angle = 50° from LCP / 45-30.
- (v) Switch on drives from LCP / ПYAPT.
- (vi) Switch on RC and simultaneously measure the readings on the milli-voltmeter. It should be minimum 10V. Otherwise, adjust the TTG elevation potentiometer for obtaining voltage $> 10V$.

0409. **Tell Back / Position Indicator Adjustment.** Tell back / position adjustment is required for accurate mounting training position (tell back) display. This display is a digital read-out in the LCP (BEL device) or as dial indication on ПYAPT. The adjustment procedures for accurate position tell back is as follows:-

- (a) Switch on all supplies from LCP / ПYAPT including rectifier.
- (b) Switch off 380 v 50 Hz 3 \emptyset supply for drives.
- (c) Switch on GMP / GM from LCP / ПYAPT.
- (d) Train mounting to 1500 mils (90°) manually. The reading on LCP / ПYAPT should be 90° .
- (e) If the reading on LCP is not 90° , then rack the stator of the tell back selsyn. This selsyn is fitted in the mounting training data receiver located in the Barbette.

CHAPTER V

Parameter Adjustments and Checks

0501. **Introduction.** The parameters of the mounting needs to be checked after completion of the STW / TT procedures enumerated in the preceding chapters. The parameters which are required to be verified / adjusted are explained in the succeeding paragraphs.

0502 **Securing Position and Accuracy Checks.** On completion of STW for Zero Sending Unit (Para 0403) and LC mode of operation (Para 0404), the following procedures are recommended for determining zeroising and locking accuracy of the mounting:-

- (a) Set Manual/Power switch, located on the hydraulic motor for training and elevation drives, in 'Power' position.
- (b) Set the training and elevation transmitters to 30° from LCP / 45-30.
- (c) Switch on drives by pressing push button 'DRV ENBL' from LCP or by switching on toggle switch for 'Drives ON' from ПYAPT (as applicable).
- (d) Switch on RC by pressing push button 'RC' from LCP or by switching on toggle switch for RC from ПYAPT (as applicable). The mounting should follow to the commanded angle of 500 mils (30°).
- (e) Switch off RC by depressing push button 'RC' from LCP or by switching off toggle switch 'RC' on ПYAPT (as applicable). The mounting should come to its securing position. The accurate confirmation of the above can be measured on B3-55 meter as per voltages indicated at Table A below:-

TABLE A

Checks	Permissible Value	B3-55 Meter Reading	B3-55 Meter Range
Accuracy of the mounting on reaching the zero position in training	2 mils	Not more than 72 mV	100 mV
Accuracy of the mounting on reaching the zero position in elevation	2 mils	Not more than 72 MV	100 mV

(f) On completion of the above measurement, switch off drives by depressing push button 'DRV ENBL' from LCP. Confirm LK lamp / Lock indication lamp on LCP / PYAPT is ON.

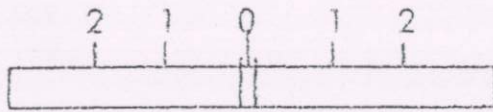
0503. **Static And Dynamic Checks.** On completion of tuning in RC mode (Para 0405), the mounting needs to be checked for Static and Dynamic errors as per voltages specified at Table B below:-

TABLE B

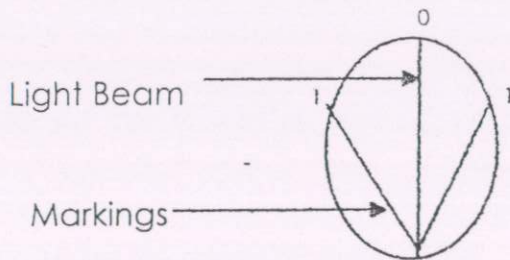
Checks	Permissible Value	B3-55 Meter Reading	B3-55 Meter Range
Static error checks in training	2 mils	Not more than 72 mV	100 mV
Static error checks in elevation	2 mils	Not more than 72 mV	100 mV
Dynamic error check in training	3-4 mils when rotating smoothly. Short duration increase in error is permitted when mounting is not rotating smoothly.	Not more than 150 mV	300 mV
		Not more than 510 mV	1 V
Dynamic error check in elevation	3-4 mils when rotating smoothly. Short duration increase in error is permitted when mounting is not rotating smoothly.	Not more than 150 mV	300 mV
		Not more than 510 mV	1 V

0504. **Checks on Beam Indicator.** The Beam Indicator is the visual indication on the Relay Unit CY panel for assessing extent of error in training and elevation follow up. On completion of tuning in LC and RC mode, the indicator needs to match with zero notch shown in the figure below. The beam checks for matching with the zero notch may vary amongst class of ships. The two types of indicator systems used are explained below:-

(a) Director Beam Type. After giving the command to the mounting to any set value of training / elevation, the light beam should not diverge more than one division to the left or right. This is an indication of the follow up error and these oscillations should settle down within 2 - 3 cycles. This type of indicator system is depicted below:-



(b) Dowel Lamp Type. After giving the command to the mounting to any set value of training/ elevation, the light beam should oscillate in clockwise and counterclockwise direction from zero position. This is the indication of the follow up error and these oscillations should settle down within 2 - 3 cycles. This type of indicator system is depicted below:-



0505 Follow-up Drive Laying Checks. The mounting needs to be checked for accurate and smooth follow-up from Optical Director System (ODS) / Kolanka Sight (as applicable). The procedure for the same is as follows: -

(a) Checks from ODS.

- (i) Set Local / Off / Remote switch in LCP to 'Remote' mode. Switch off drives.
- (ii) Switch on the ACP by pressing 'ACP ON' push button.
- (iii) Press 'ALOFT' push button in the 'ALOFT CONTROL' section of the ACP. Red LED and hooter located at ODS are activated.
- (iv) Press 'ALOFT ACK' push button on the ODS. The hooter on the ODS mutes and red LED located in the ACP aloft control section under particular mounting lights up.

(v) Press 'DRV ENBL' push button on ACP for the mounting being checked. Gun unlocks and drives are switched on. 'UNLK' lamp lights up at ACP.

(vi) Move the mounting in training and elevation from limit to limit to check smooth follow up.

(b) Checks from Kolanka Sight.

(i) Switch on 'GMP' on ПYAPT panel. Set selector switch to 'SIGHT' mode.

(ii) The hooter associated with Kolanka sight is activated and light indication is available on the sight. When the sight operator takes over control by pressing 'CONTROL TAKEN' on sight, the hooter mutes and 'SIGHT' mode indication is available on the ПYAPT panel.

(iii) Switch on 'DRIVES' on ПYAPT.

(iv) Gun unlocks and 'UNLOCK' lamp indicates on ПYAPT.

(v) Switch on RC.

(vi) Move the mounting in training and elevation from limit to limit to check smooth follow up.

0506 Checks for 'Sitting On Stops'. After adjustment of the braking angles as per Para 0406, the mounting needs to be checked for adequate deceleration and accurate braking. The parameters to be checked are as follows:-

Checks	Permissible Value	B3-55 Meter Reading	B3-55 Meter Range
Speed of 'sitting on stops' for training	10°/sec Maximum	1.5 V Maximum	3 V
Speed of 'sitting on stops' for elevation	10°/sec Maximum	1.5 V Maximum	3 V

0507 **Accuracy Check of Mismatch Error.** After adjusting the mismatch error relay in CY, the mounting needs to be checked for follow up accuracy from associated FCR / sight. The permissible values for mismatch error are specified at Table C below:-

TABLE C

Checks	Permissible Value	B3-55 Meter Reading	B3-55 Meter Range
Value of displacement error of gun in response to when firing is interrupted in training	8 -16 mils	290 - 580 mV	1 V
Value of displacement error of gun in response to when firing is interrupted in elevation	8 -16 mils	290 - 580 mV	1 V

0508. **Firing Circuit Checks.** The firing circuit checks needs to be carried out after measuring MISMATCH error as explained above.

(a) Precautions / Procedure for Firing Circuit Checks.

- (i) Switch off supplies. Ensure mounting in firing zone.
- (ii) Rotate the cluster using the handle to ensure the gun mount is free from any rounds.
- (iii) Ensure that the cartridge belt is lowered in the magazine beyond the pneumatic puller.
- (iv) Press push button GMP ON / GM ON at LCP / ПYAPT.
- (v) Press push button DRV ENBL / DRV ON at LCP / ПYAPT. Switch on RC. Check that the mismatch lamp is not glowing.
- (vi) Press push button FC ENBL / FC ON to switch on firing circuit from LCP / ПYAPT.
- (vii) FC READY lamp should glow indicating FC is ready.

(b) Firing Contact Checks with Dummy Cartridges.

- (i) Rotate the cluster with handle to ensure that mounting is free from any rounds.
- (ii) Ensure push buttons DRV ENBL, RC and FC should be depressed i.e. set in OFF position on LCP. In case of ПYAPT, the toggle switches Drive, RC and FC should be in off position.
- (iii) Press push button GM ON from LCP to switch on power supply for the mounting.
- (iv) Press push button FCC / FC on LCP / ПYAPT.
- (v) Simultaneously turn the cluster manually through one revolution while stowing 06 nos. dummy cartridges in succession on the feed sprocket of AO - 18. Pilot lamp FCC / FC should light up six times on LCP / ПYAPT.

(c) Firing Circuit Checks in ODS Mode / Kolanka. The firing circuit needs to be checked in sight mode from ODS / Kolanka. The procedure for the same is as follows: -

- (i) Check that gun mounting is fully unloaded.
- (ii) Ensure that the cartridge belt is lowered in the magazine beyond the pneumatic puller.
- (iii) Press push button GMP ON / GM ON from LCP / ПYAPT.
- (iv) Open HP air for the system.
- (v) Give control to the ODS / Kolanka from ACP / ПYAPT.
- (vi) Press push button 'DRV ENBL' and 'RC' at LCP or Switch on 'RC' and drive from ПYAPT panel.
- (vii) Press push button 'FC ENBL / FC' on LCP / ПYAPT to switch on firing circuit.
- (viii) ODS / Kolanka operator should press the firing push buttons when gun is in firing zone resulting in cluster rotation.

- (ix) Move the gun to danger zone and press firing push buttons. During this check, the cluster should not rotate.

0509. **Speed Checks.** After completion of follow-up speed checks, the following values specified at Table E below needs to be verified:-

TABLE E

Checks	Permissible Value	B3-55 Meter Reading	B3-55 Meter Range
Speed in training	70°/sec Minimum	10 V Minimum	30 V
Speed in elevation	50°/sec Minimum	10 V Minimum	30 V

0510. **Checks for Pneumatic Starter and Gas Ignition Mechanisms.** After completion of mounting STW, the Pneumatic Starter and Gas Ignition Mechanisms need to be checked. The procedure for the same is as under: -

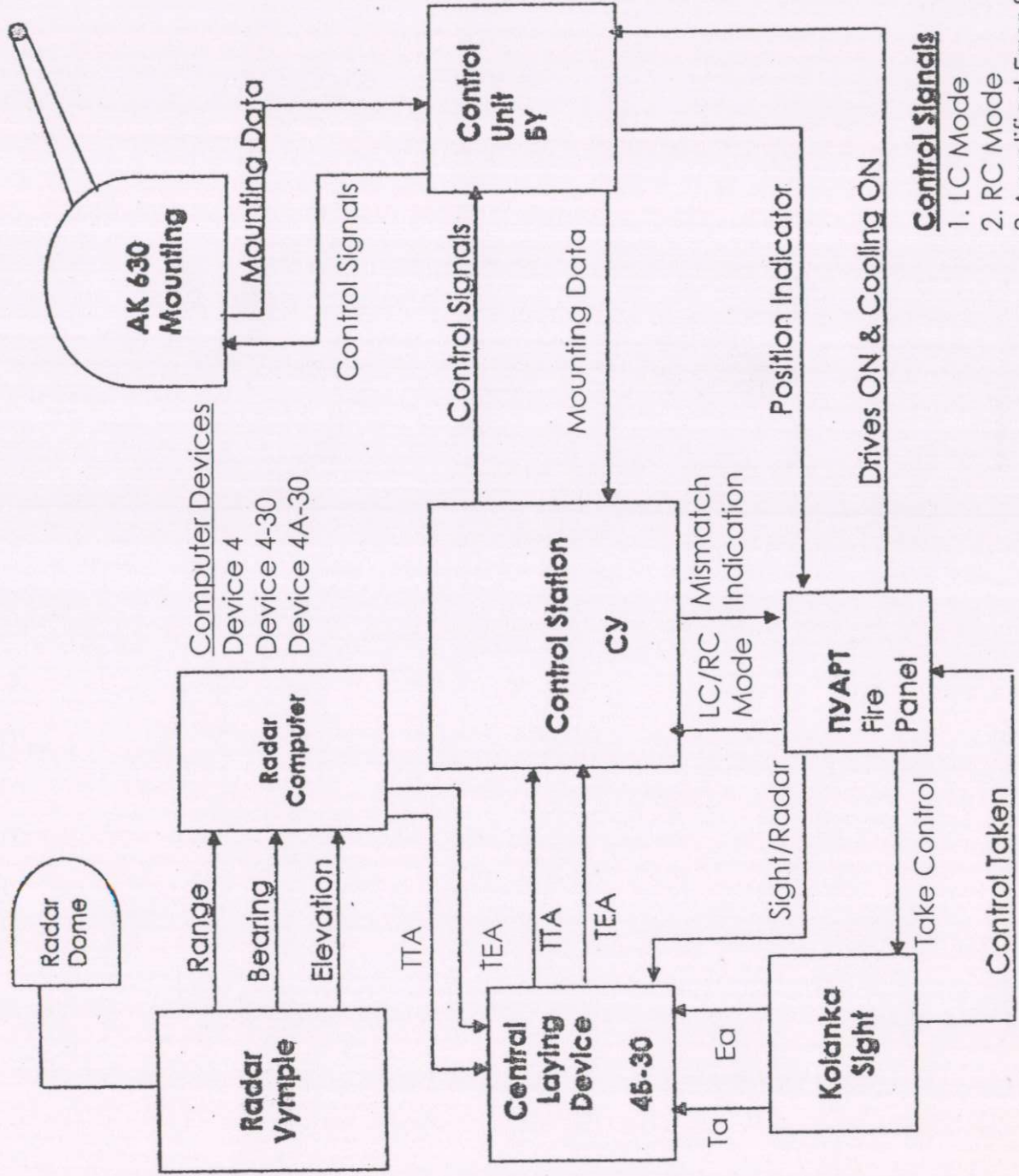
- (a) Ensure that the mounting is fully unloaded.
- (b) Ensure cartridge belt is beyond the reach of pneumatic puller.
- (c) Disconnect Cable No. 23 (Ш 33) of the Control Unit to prevent operation of the pneumatic puller.
- (d) Press push button GMP ON / GM ON at LCP / ПУАРТ to switch on power supply for the mounting.
- (e) Switch on drives and RC.
- (f) Give control to ODS / Kolanka and check mounting is not in danger zone.
- (g) Press firing push button from ODS / Kolanka and visually check the cluster rotation and occurrence of sparks at the three spark plugs.

**BREAK-UP OF ESTIMATED 95 MAN-DAYS FOR AK 630
STW / TT & TRIALS ONBOARD NEW CONSTRUCTION SHIPS**

S No	ACTIVITY / STAGE	MAN-DAYS
1.	<p><u>Visual Inspection</u> Damaged components / units, cracks / corrosion in pipe joints, condition of rubber gaskets, cable-sleeves and hydraulic filters for training / elevation, mounting greasing, manual training / elevation of the mounting by handle and working condition of training / elevation buffers.</p>	05
2.	<p><u>Check Wire</u> 45 nos. cables from BY (Control Post) to mounting, two nos. cables from LCP to CY (Control Station) / BY (Control Post) and two nos. cables from Optical Director System (ODS) to ACP / LCP.</p>	14
3.	<p><u>Cooling System Checks</u> Cooling tank conditions, water level, leakage from the hoses and free rotation of the pump impeller by hand. Switch on cooling pump from LCP Panel and check functioning of both cooling signal lamps. During cooling system operation, visually check that approx. 60 - 100 drops / minute should pass through oil seals.</p>	03
4.	<p><u>Insulation Checks</u> Check the winding insulation for the following units / devices as per Appendix 10 of TD / OI:- Training TG, Elevation TG, Training EM, Elevation EM, Training Motor, Elevation Motor, EK 1, EK 2, EK 3, EK 4 and EK 5, Firing Ignition Mechanism КП 1, КП 2 and КП 3, Cooling Sensor, Round Counter Sensor, Firing Circuit Contactor, Training and Elevation angle limiters, Training Lock and Cooling Motor.</p>	05

SNo	ACTIVITY / STAGE	MAN-DAYS
5.	<p><u>Pneumatic System Checks</u></p> <p>Leakage from air bottle and air pipe joints inside mounting, Pneumatic puller and Feeder mechanism checks by manually operating electromagnetic valve EK.</p>	03
6.	<p><u>Firing Arc Checks</u></p> <p>Firing arc checks in training and elevation as per Service Log / Polar Diagram for class of ship.</p>	04
7.	<p><u>Mounting STW / T & T</u></p> <p>(a) <u>CY (Control Station)</u>. Adjustments for locking / unlocking from LCP, securing position checks from LCP, laying drives follow up from LCP, firing circuits / FC readiness.</p> <p>(b) <u>ODS / Mounting / LCP</u>. Pneumatic starter and gas ignition mechanism checks by pressing firing push button, deceleration angle and electrical braking checks of the mounting and mounting follow-up (training and elevation), firing circuit checks from LCP with dummy cartridge for firing contactor operation, danger zone and firing circuit operation with ODS.</p>	24
8.	<p><u>Parameter Adjustments</u></p> <p><u>CY (Control Station) using B3-55 meter</u>. Training speed of 70° per second (minimum 10V), elevation speed of 50° per second (minimum 10V), braking speed (sitting on stops) in training and elevation of 10° per second (maximum 1.5V), static error in training and elevation of less than 2 mils (maximum 72 mV), mounting accuracy of 2 mils on reaching the zero position in training and elevation (maximum 72 mV), mounting displacement error of 8 - 16 mils in training and elevation for FC interruption (290 - 580 mV), dynamic error in training and elevation of 3 - 4 mils while moving mounting from ODS smoothly (150 mV) and not smoothly / with jerks (362 - 510 mV).</p>	26
9.	<p><u>Presentation of ATF, HATs and SATs</u></p>	11

BLOCK DIAGRAM OF AK 630 WITH MR 123 / VYMPLE



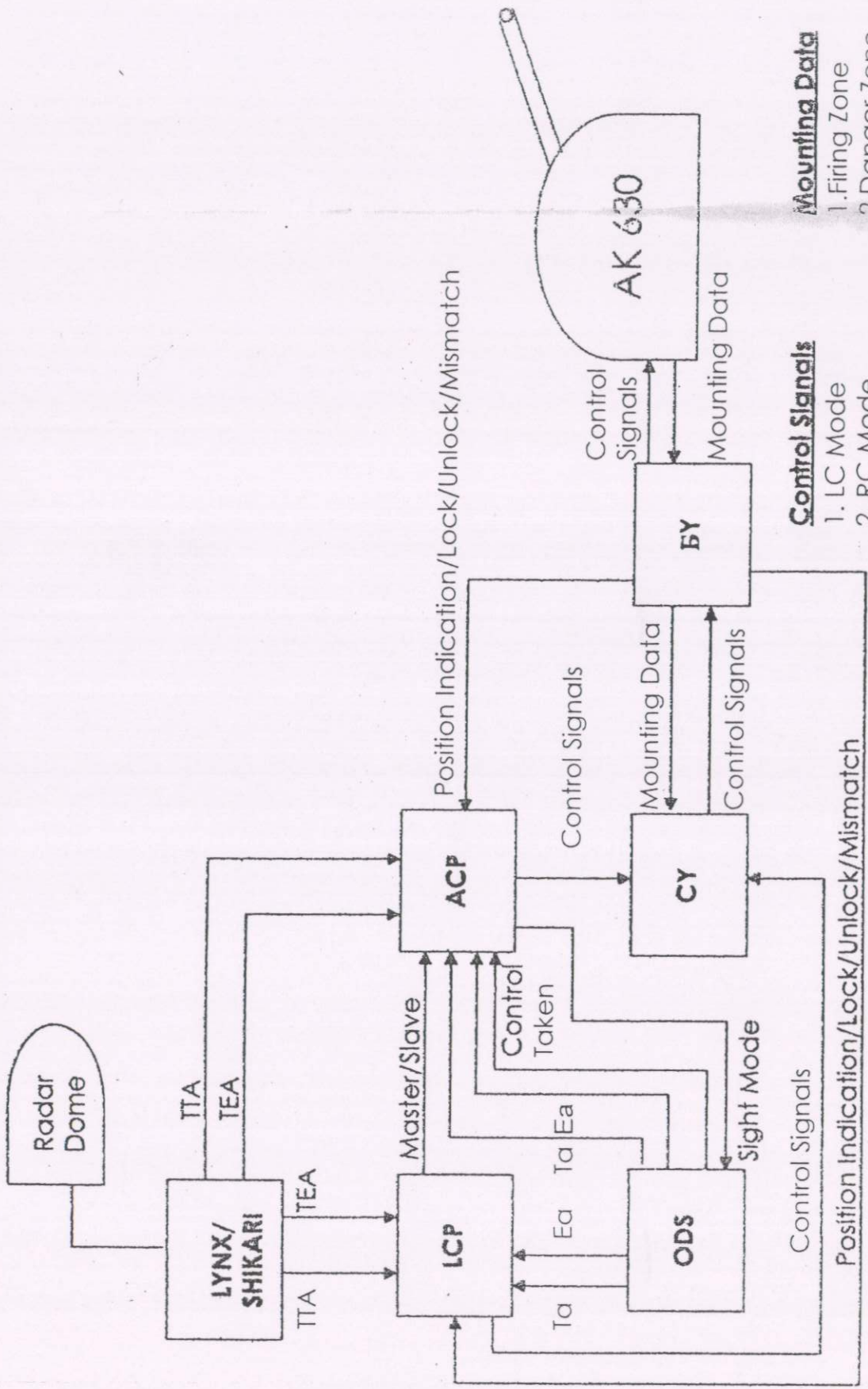
Control Signals

1. LC Mode
2. RC Mode
3. Amplified Error Signal
4. Firing Interruption

Mounting Data

1. Firing Zone
2. Danger Zone
3. Lock
4. Un lock

BLOCK DIAGRAM OF AK 630 WITH LYNX / SHIKARI



Mounting Data

1. Firing Zone
2. Danger Zone
3. Lock
4. Un lock

Control Signals

1. LC Mode
2. RC Mode
3. Amplified Error Signal
4. Firing Interruption

SPARES / SPTA EXPENDED DURING STW / TI PROCESS

S.No	Description	Recommended Quantity
1.	Gasket - 7152430404	02
2.	Air pressure Gauge - MBY - 100	01
3.	Relay Tke-52 ΛΔ-7553810044	02
4.	Relay Tke-52 ΛΔ-7553810057	02
5.	Relay Pm-21A-3425830911	02
6.	Valve-7142410259	02
7.	Capacitor K-50-20-100-200-6151263151	02
8.	Semiconductor Diode 2Δ 20Π -621122x174	02
9.	Micro switch 2Δ 701-7554110067	02
10.	Time Relay Э MPB-276-4218780093	02
11.	Fuse ΛΔC-Им3	03
12.	Gasket-7152430691	02
13.	Sealing Ring-7142410113	02
14.	Disc spring-7152430811	02
15.	Electro Pneumatic Valve ЭК-48	01
16.	PCB of Rectifier Unit (Panel) 6(D) (ZH) 387.66	01
17.	Air Reducer - 150 - 70Kgt/Cm ²	01

POINTS FOR INSULATION MEASUREMENT

Sub - Unit / Device	Cable	Щ, Connector	Contact Nos.
Training TG	06	21	1- 3, 1, 3 & frame
Elevation TG	02	16	1- 3, 1, 3 & frame
Training EM	07	22	6 - 7,, 6, 7 & frame
Elevation EM	03	17	6 - 7, 6, 7 & frame
Training Motor	25	26	1& earth
Elevation Motor	24	25	1& earth
Winding of EK 1	11	07	1& earth
Winding of EK 2	12	08	1& earth
Winding of EK 3	13	09	1& earth
Winding of EK 4	22	10	1& earth
Winding of EK 5	23	33	1& earth
K П 1	17	01	1& earth
K П 2	21	02	1& earth
K П 3	33	03	1& earth
Cooling Sensor	32	05	1- 2, 1, 2 & frame
Counter Sending Unit	30	13	1& earth, 1, 2 open
Firing Circuit CM	19	11	1- 2, 1, 2 & earth
Training angle limiter	08	23	1& 2, 1& 3, 1, 2, 3, 4
Elevation angle limiter	04	18	1& 2, 1& 3, 1, 2, 3, 4
Training Lock	10	06	2 - 3 lock, 2-1 unlock
Firing Contactor	15	12	1- 2
Cooling Motor	37	27	1& earth

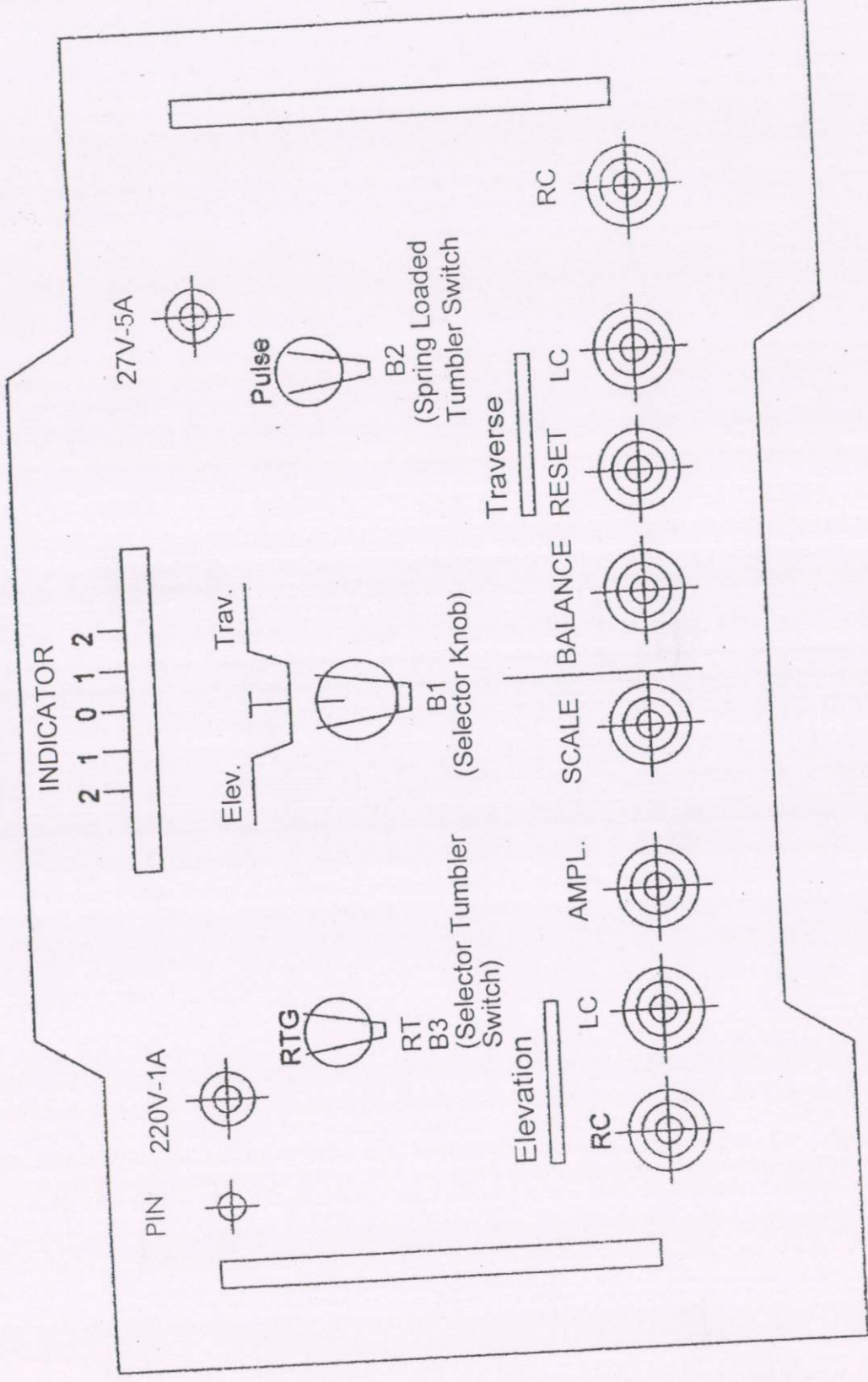
Note :-

- (a) Insulation measurement for training, elevation and cooling motors (Щ, 25, 26 & 27) are to be undertaken using 500 V Megger.
- (b) 100V Megger is to be used for insulation measurement of balance serials.

Appendix C

(Refers to Para 0404, 0407)

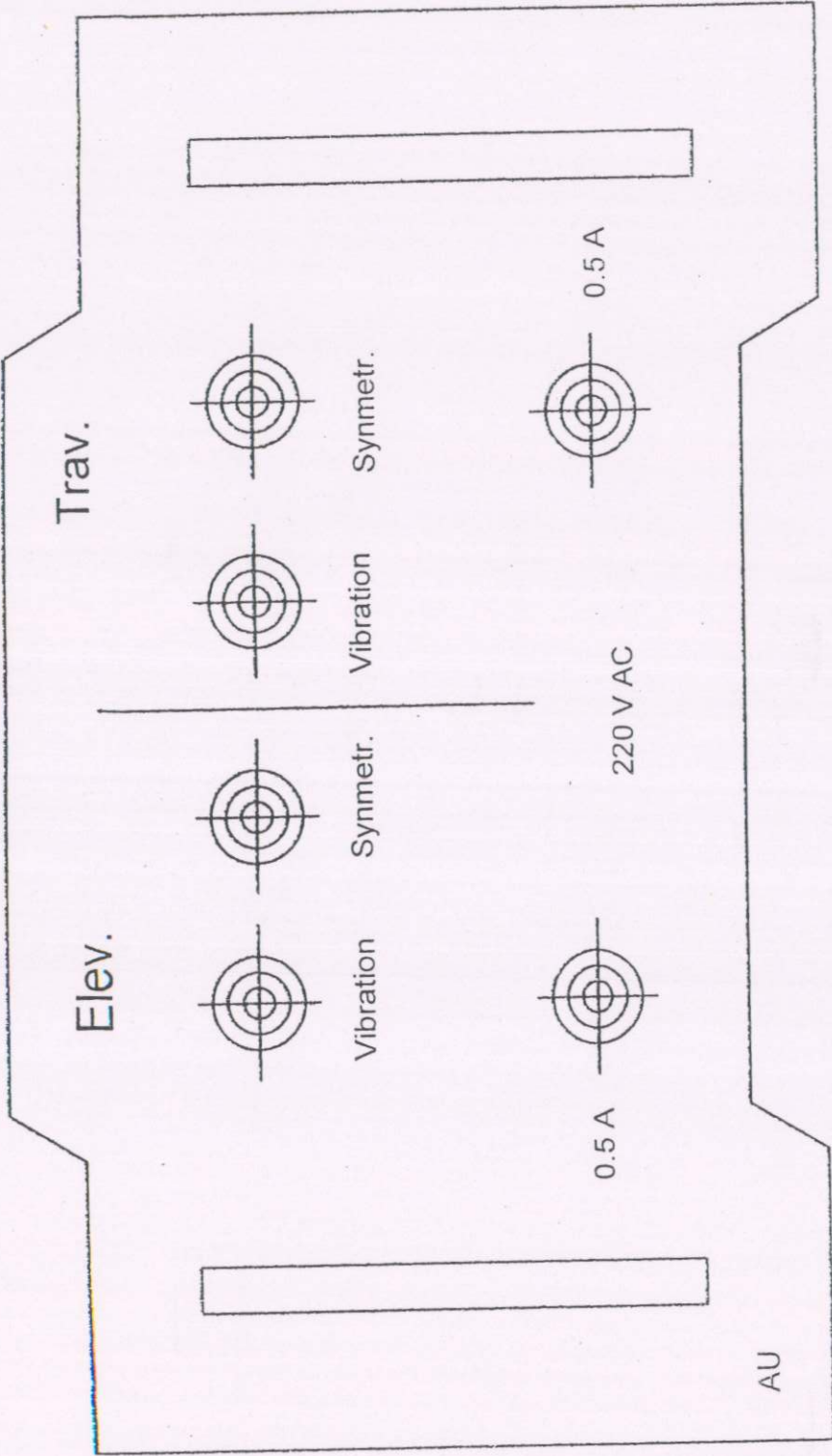
RELAY UNIT



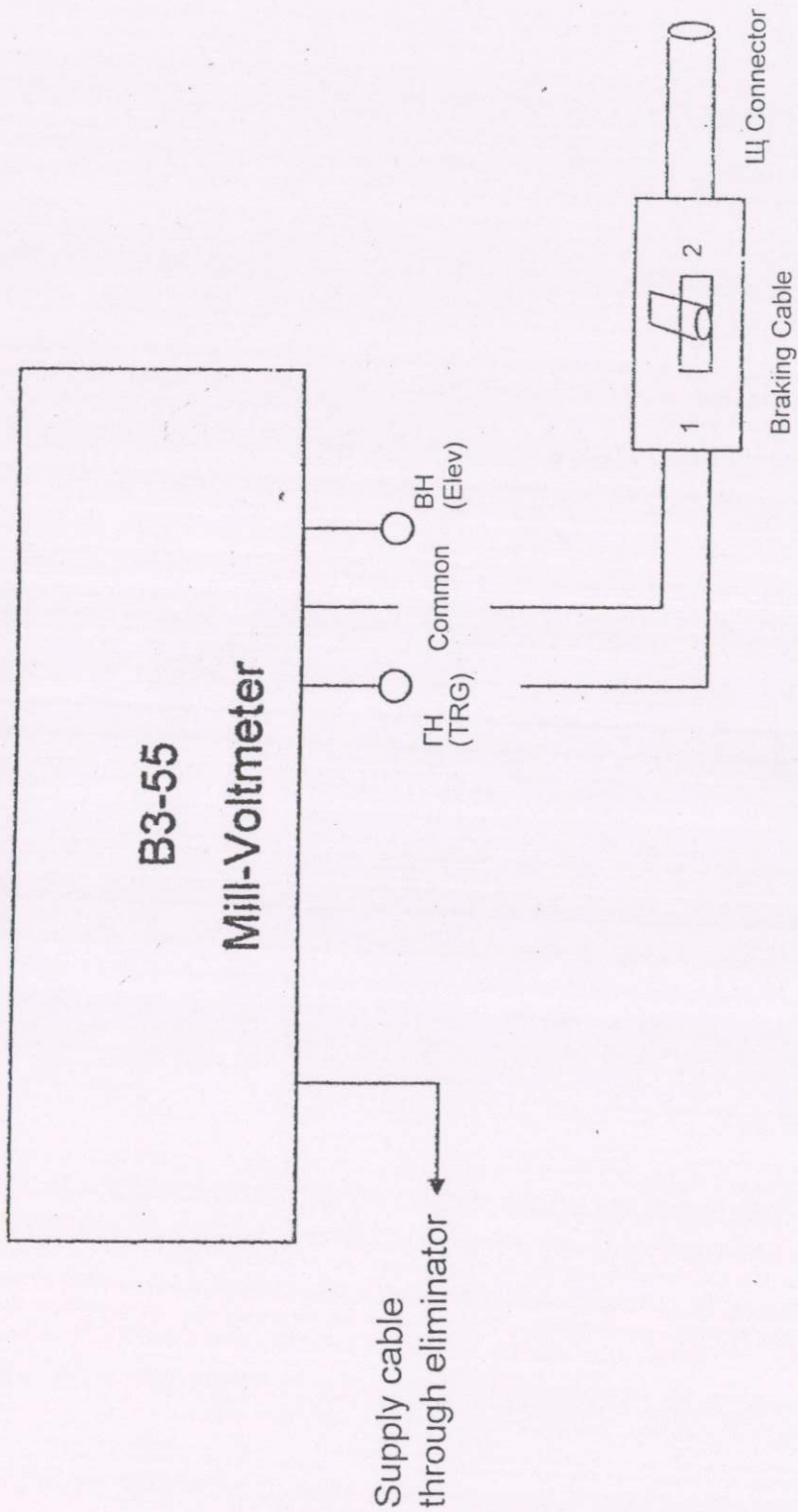
Appendix H

(Refer to Para 0405)

AMPLIFIER UNIT



TUNING IN BRAKING MODE



SWITCHING UNIT

