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# MAINTENANCE HANDBOOK ON ELECTRIC LIFTING BARRIER

CAMTECH/2007/S/ELB/2.0

MARCH 2007



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*Excellence in Maintenance*

**Maharajpur, GWALIOR - 474 020**

**MAINTENANCE HANDBOOK  
ON  
ELECTRIC LIFTING BARRIER**

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# **PREFACE**

CAMTECH is continuously putting efforts in the field of documentation and up-gradation of information on maintenance practices. Failure of Electric Lifting Barrier affects punctuality of trains on Indian Railways very badly. Keeping this in view a maintenance handbook on this subject was prepared in the year July 2000 to help the Maintenance staff to provide trouble free working of Electric Lifting Barrier. This handbook is now revised to incorporate improvements in subsequent years such as hand generator backup for Electric Lifting Barrier.

It is clarified that this handbook does not supersede any existing provisions laid down in “Signal Engineering Manual”, Railway Board publications and RDSO publications. This handbook is not statutory and instructions given in it are for the purpose of guidance only.

We are sincerely thankful to Shri Vipul Goel, Joint Director (Signal)/ RDSO, M/s Heidz India, New Delhi and field personnel who helped us in the revision of this handbook.

Since technological upgradation and learning is a continuous process, you may feel the need for some addition/modification in this handbook. If so, please feel free to write us. We shall be highly appreciating your contribution.

***CAMTECH GWALIOR***  
***DATE 30.03.2007***

***JAGMOHAN RAM***  
***DIRECTOR (S&T)***

# **FOREWORD**

This handbook is prepared and subsequently revised for uniform and better maintenance of Electric Lifting Barrier, which plays a vital role in the safe running of trains as well as road traffic. This handbook is targeted for the ESM and supervisory staff of Signal Department.

I hope that this handbook will be very useful for the maintenance staff in their day to day working related to above subject. All the concerned staff should, in their own interest get thoroughly acquainted with the maintenance practices given in this handbook which will be helpful in giving trouble free service and minimum maintenance expenditure.

***CAMTECH  
GWALIOR  
DATE 30.03.2007***

***KUNDAN KUMAR  
EXECUTIVE DIRECTOR***

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# **ELECTRIC LIFTING BARRIER**

## **1. Introduction**

A crossing where Railway track crosses the road at the same level is termed as level crossing. To avoid accidents at these level crossings, gates are provided.

## **2. Classification of Gates**

There are five types of gates.

- Special class –manned- for road traffic
- ‘A’ class- manned- for road traffic
- ‘B’ class- manned- for road traffic
- ‘C’ class-manned if required- for road traffic
- ‘D’ class- Unmanned- for cattle crossing

Either lifting barrier, leaf gates or chains are used to close the gates. Lifting barriers are mainly operated in two ways.

- Mechanical (Gateman opens the gate by operating the handle)
- Electrical (Button operated)

## **3. Advantages of Electric Lifting Barrier**

- Electric lifting barrier is reliable and its working capacity is high.
- Since its operating time is less, opening and closing is prompt which reduces the chances of damage to boom due to heavy road traffic.
- Requires less maintenance.

- Electric lifting barrier is comparatively safe and there is no chance of outside interference.
- In case of power failure, it can be operated with the help of crank handle. Crank handling of electric lifting barrier is easy because its counter weight is less and balanced.

#### **4. General Features**

- Electric Lifting barrier is manufactured according to the following two specification:
  - » IRS:S 41/70 with Amdt. 2: It covers both AC (110V) & DC (24 V & 110 V) motors without hand generator unit.
  - » RDSO/SPN/180/2005 with Amdt.1: It covers only DC motor (24 V /110 V) and is with hand generator.
- Lifting barrier is robust and operating mechanism is protected against unauthorised interference.
- The boom of the barrier is light in construction and extends across the full width of the road.
- The height of the boom is kept 1 m. from the rail level.
- Fringes, if provided, are made clear of road surface by not more than 15 cm. when the boom is in the horizontal position.
- The raised or open position of the lifting barrier is with in 85°-90° from the horizontal and lowered or closed position is within 5° from the horizontal.
- At the centre of the boom, the lifting barrier is provided with a 600 mm dia. red disc having red reflector buttons facing the road traffic.
- Lifting barrier can be stopped, reversed or its movement obstructed at any point during operation without damage.



- The mechanism is so designed and booms are so balanced that in case of failure of power supply, the barrier remains in the last operated position.
- The mechanism is so designed that if the boom is obstructed during operation, it stops and on removal of the obstruction assumes the position corresponding to the control apparatus, unless protected devices have operated.
- Lifting barrier have two booms one across the road on either side of the level crossing, operated by independent mechanism.
- Arrangements are provided to adjust the counter balance of the lifting barrier.
- The operating mechanism also includes a suitable device which locks the lifting barrier in the vertical and horizontal positions.
- Electrical contacts are easily accessible and independently adjustable and conform to IRS specification No. S-23.
- Bearing conforms to IRS specification No. S-23 and is constructed so as to prevent entry of water.
- Exposed oil holes, cups or grease nipples are provided with waterproof spring loaded covers.
- In case of power failure, lifting barrier is operated manually by a crank handle. The insertion of hand-crank disconnects the power supply to the motor and it is not possible to reconnect the power supply until the hand-crank is withdrawn, and a switch is operated.

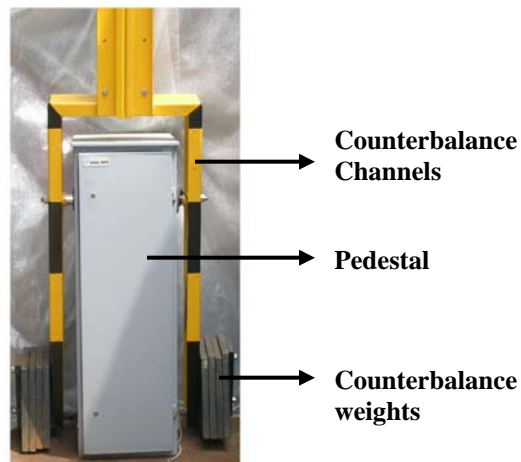
## **5. Main Parts of Electric Lifting Barrier**

An electrically operated device for closing the level crossing against road traffic comprises of an

operating/control panel, an electric motor, operating mechanism, circuit controller, road signals, audible devices, boom etc.

### 5.1 Pedestal

It is provided with two Nos. of pedestals consisting of 110 V AC/110 V DC/24 V DC (as per requirement) reversible motor of adequate capacity for max. 32 ft. long boom, along with complete gear drive (preferably sealed type) with main shaft, connecting links etc., friction clutch, 8 band circuit controller with cam operated limit switches, hand crank arrangement for manual operation at time of generator/cable failure with cutout limit switch. Wiring is terminated on elmex terminals provided inside the pedestals [refer Fig.1(a), (b) & (c)].



*Fig 1 (a)*

*Fig 1 (b)**Fig 1 (c)*

- Fully Enclosed Weather Proof Pedestal with 2 Doors.
- Lightweight Aluminium Boom up to 32 ft. long
- Adjustable M.S. counterweights
- Housing 2 Stage Gear Box
- Friction Clutch
- PMDC Motor
- Main Boom Shaft
- Special linkage System
- 8 Contact Circuit Controller

## 5.2 Boom

It is that part of barrier, which in horizontal position prevents passage across level crossing. Two booms, one each on either sides of track is provided.

Each set consists of two number of booms of length 20/24/32 ft. of aluminium having 3 to 4 sections joined by nuts and bolts for easy replacement. The boom is painted with alternate black and yellow stripes each of 300 mm. with a red disc at centre along with boom light box with protective mesh. In horizontal position, the boom height is kept 1 meter from rail level.

### 5.3 Counterbalance channels and weights

These are provided for fixing the boom to the mechanism and for counterbalancing the weight of the boom. These are made up of M.S.(Refer Fig.1)

### 5.4 Control Panel



*Fig 2: Control Panel*

- A control panel is provided to operate the two booms individually as well as simultaneously through two selector switches.
- The control panel may be either of the miniature lever type or push-button type with suitable arrangements to stop the barrier at any position.
- Approved type contactors are provided in control panels for the operation of lifting barrier.
- Two push buttons red and green are provided to open and close the lifting barrier, respectively. The barrier operates as long as corresponding button is pressed and stops when the button is released.

- A barrier motor (toggle type) switch of 10A rating is provided to control feed to motor (Motor ON/OFF).
- For lifting barrier with hand generator device a selector switch (MANUAL/AUTO) to select hand generator operation/auto push button operation is provided.(Ref. Fig.2)

### **5.5 Electric Motor**

- Motor is totally enclosed type and forms an integral part of the mechanism and is readily removable therefrom.
- Motor bearing is so designed that lubricant used can not reach to brushes, commutator or winding.
- Suitable protective device like circuit breaker in addition to friction clutch is provided to disconnect the circuit in case of over-loading of motor.

### **5.6 Mechanism Case**

- Mechanism case is of metal, strong and weatherproof.
- It has ample space to accommodate various apparatus and wiring.
- A suitable gasket is provided on the mechanism case between case and its door to protect it from entry of water and dust.
- Arrangement is provided for rigidly securing and padlocking the door of the mechanism case.
- The door or cover when open, permits easy access to all parts.

### **5.7 Solenoid boom lock**

It consists of a solenoid and locking lever inside boom rest stand. When the boom comes in closed position, the solenoid is de-energised and the locking lever falls over boom hook (fixed to boom tip) and locks the boom by gravity. A sealed proximity switch is provided for boom lock proving which makes only when boom hook falls into place and locking lever is in locked position. The boom is unlocked by energizing the solenoid



**Fig.3(a) Locking by gravity**



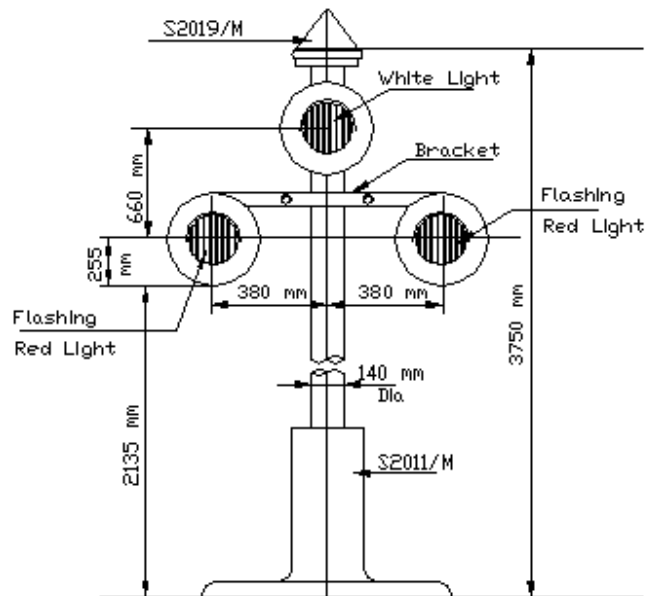
**Fig.3(b) Unlocking by energizing solenoid.**

## 5.5 Road Signals

- Audible and Visual warning arrangement for the road traffic are provided along with lifting barrier, on each side of lever crossing.
- The Audible warning arrangement consists of red and yellow aspects of RDSO approved LED signal/signal lamp and Ding-Dong bell fitted in three aspect signal units as per RDSO Drg. No. SA 23002A/M. The operation of Ding-Dong bell and signal aspects is on the same voltage (24V/110V) as of the barrier operation.
- Audible and Visual warning arrangements for the road traffic start operating when the barrier moves from its vertical or open and continues till both the

booms reach within 10 degree of the horizontal position.

- The road signals on each side of the railway crossing are positioned so as to face outwards from the crossing towards approaching road traffic with a continuous visibility of 400 m except on curves.
- A steady red light is displayed when the boom is horizontal and when the boom is being raised till the boom assumes the vertical position. thereafter a steady yellow light is exhibited to the road traffic.



**Fig 4**  
**Typical Diagram for Road Signal with Electric Lifting Barrier**  
 (reference RDSO Drg. No. SDO/2093)

## **6. Control Circuit**

The control circuit operates the motor through contactor units provided in relay room. The control circuit for operating motor contactor coils should also take care of following:

- The two contactors should be interlocked so that when one is picked up, the other does not pick up.
- If either of the two crank handle cutout switches for the two barriers of a set are operated, electrical operation of both the barriers of the set should be cut off.

## **7. RDSO Approved Electric Lifting Barrier**

The RDSO approved manufacturers of Electric lifting barrier are:

- M/s Heidz India Ltd., New Delhi
- M/s Signal & Telecomm. Workshop, South Central Railway, Mettuguda, Secunderabad

## **8. Types of Electric Lifting Barrier**

There are three types of Electric Lifting barrier used according to the requirement and availability of power supply:

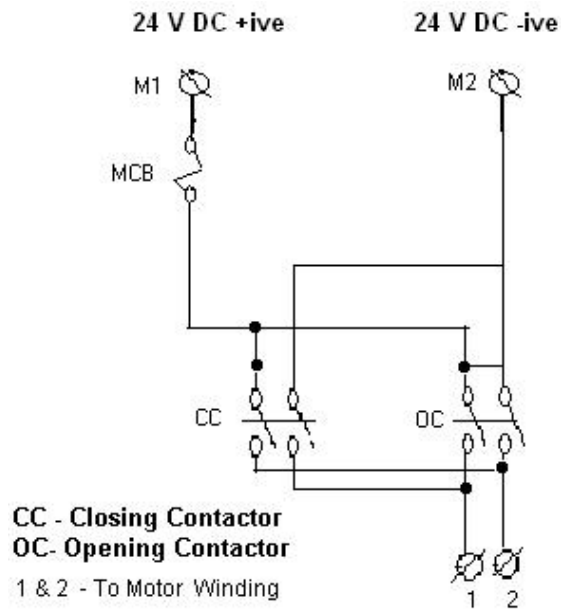
### **8.1 110v Dc & 24 V Dc Electric Lifting Barrier**

This barrier works on 24 V DC or 110 V AC depending on the motor provided in it.



### Cabling required

- a) 4 core cable between each barrier machine and relay rack for motor and solenoid lock.
- b) Min. 22 core cable between each barrier machine and relay rack for circuit controller contacts and boom light.
- c) Min. 4 core cable between each barrier machine and its corresponding boom lock fixed at the other end of road.
- e) Necessary cables for road signal/ audio warning.
- f) Necessary cable between barrier control pane and relay rack probably min. 16 core depending on Relay circuit.



*Fig 5*  
**Motor contactor and MCB wiring for 24 V DC**

**Motor**

The motor provided is a 24 DC or 110 V Permanent Magnet DC (PMDC) 2 wire motor.

**Boom Light**

The boom light is LED based and works on 24 V AC or DC. If 110 V supply is to be given, an approx 12-15 K Ohm resistor should be fixed in series with light circuit.

**Solenoid Lock**

The solenoid lock works on 24 V DC supply. It needs to be energized only at the start of opening.

**8.2 24 V Dc with Hand Generator Operated Electric Lifting Barriers****Hand Generator**

It consists of an electrical generator of adequate capacity to power both motors of one set of barriers. Voltage system of generator is same as that of the motors in pedestal i.e. 24 V or 110 V DC. Hand generator enables the gateman/switchman to operate both barriers of a gate with a very low effort by rotating a crank handle attached to the hand generator unit. The generator is coupled to a sealed type oil filled maintenance free gear unit to multiply slow rate of rotation of crank handle to run the generator. The generator unit also have push buttons for push button operation. Selector switch is provided to select Hand generator operation/auto push button operation.

Another Selector switch is provided to operate one or both barriers as desired.



- **Hand generator unit is pedestal mounted, and works just like a winch of conventional winch type barrier.**
- **Rotate crank handle clockwise for closing, and anti clockwise for opening.**
- **Selector switch for Power/ Manual operation**
- **Open and Close Buttons**
- **Selector switches for controlling each barrier**
- **Toggle switch for staggering load**

*Fig 6: Hand Generator Unit with push buttons and selector switches*

**Cabling required**

- a) A minimum 5-core cable between generator & each pedestal.
- b) A minimum 4-core cable between each solenoid lock coil and respective barrier pedestal.
- c) Cabling as required for Signalling circuits, interlocking etc.
- d) 24 V DC Power Supply (10 amps) to Hand Generator, in case option of automatic push button operation is required.

**Motor wiring**

- The motor provided is a permanent Magnet DC Motor (PMDC Motor), having only one winding with two wires connected to terminals 5 & 6 in barrier pedestal.
- By giving 24 V DC Positive to terminal 5 and negative to terminal 6, the motor rotates in one direction. By reversing the polarity, the direction of motor rotation is reversed.
- This reversal of polarity is achieved by reverse rotation of the hand generator crank or by the reversal circuit for push button operation.

- The auto power cutoff to the motor in the fully closed and open position is achieved by the Limit Switches LS1 & LS2.
- Two diodes (in opposite directions), are provided in series with each limit switch, so that one switch is in circuit while opening and the other while closing.

### **Solenoid Lock**

The solenoid lock works on 24 V DC supply and needs to be energized only at the start of opening the feed is given through the N-O contact of switch LS3A, as per Pedestal circuit given in Fig.6.

### **Boom Light**

The boom light is LED based and works on 24 V DC.

The pedestal and hand generator wiring of a typical 24 V Hiedz Electric Lifting Barrier is given in Fig. 7 on next page:

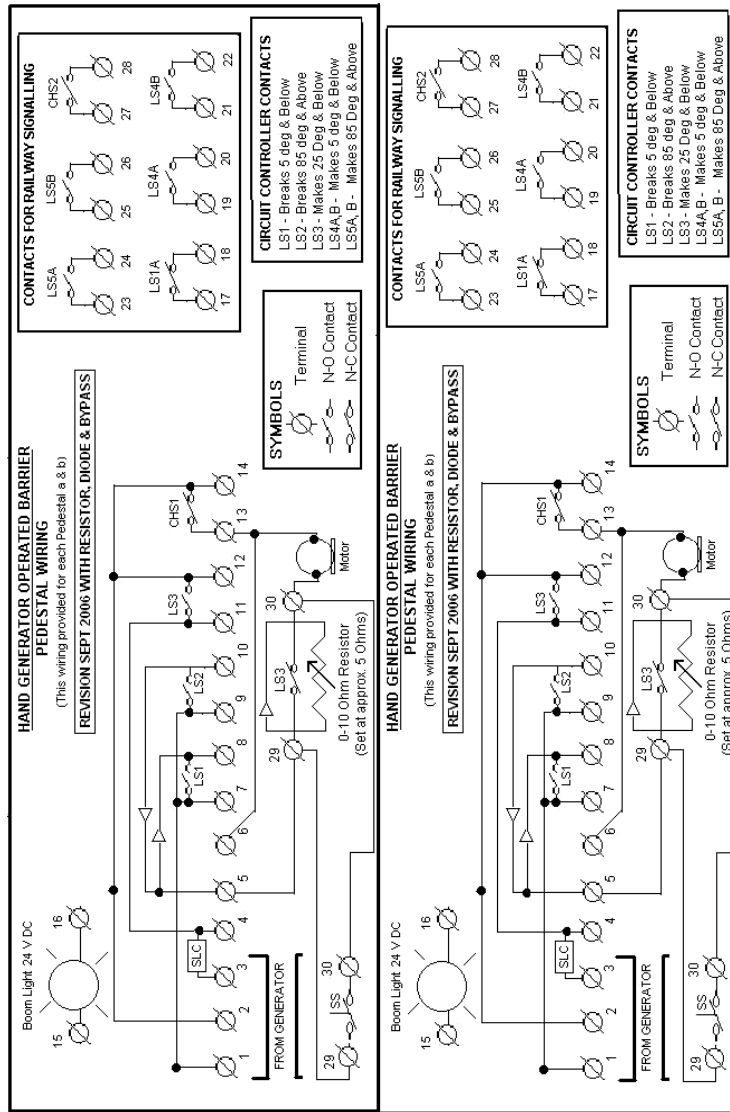


Fig. 7:

*Pedestal & Hand Generator wiring of a typical 24 V Hiedz Electric Lifting barrier with Hand Generator Backup.*

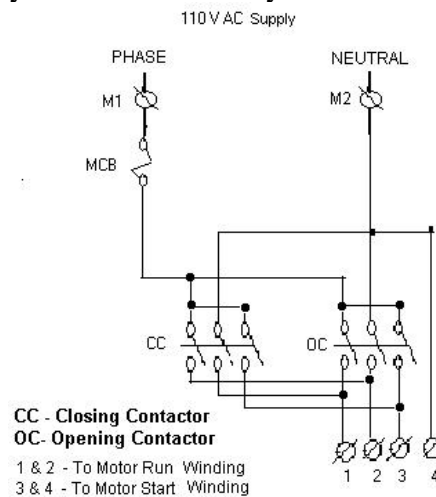
### 8.3 110 V AC ELECTRIC LIFTING BARRIERS

#### Cabling required

The cabling required is same as that for 24 V DC Electric lifting barrier without hand Generator backup.

#### Motor wiring

- The motor provided is a capacitor start and run induction motor, with two windings called running winding and starting winding.
- The 110 V AC supply has to be given to both windings separately and simultaneously for motor to operate.



**Fig 8: Motor Contactor and MCB Wiring 110 V AC**

### **Solenoid Lock**

The solenoid lock works on 110 V AC supply. Solenoid should be energized only while opening of barrier and not while closing of barrier. This can be achieved by connecting solenoid coil to terminals 1 & 4 of mechanism box or terminals 1 & 3 in case of error in the circuit. Feed to motor and solenoid coil is given simultaneously at the start of opening.

### **Boom Light**

The boom light is LED based and works on 24 V AC or DC. If 110 V supply is to be given, an approx 12-15 K Ohm resistor should be fixed in series with light circuit.

## **9. Installation**

### **Foundation**

- A small concrete foundation is required for mounting the barrier machine, as per detail given in Fig.
- A GI/ PVC pipe bend should be installed at the center of the foundation bolts for entry of power and control cables.
- The dimensional accuracy of bolt centers is important to ensure exact fitting of barrier machine.



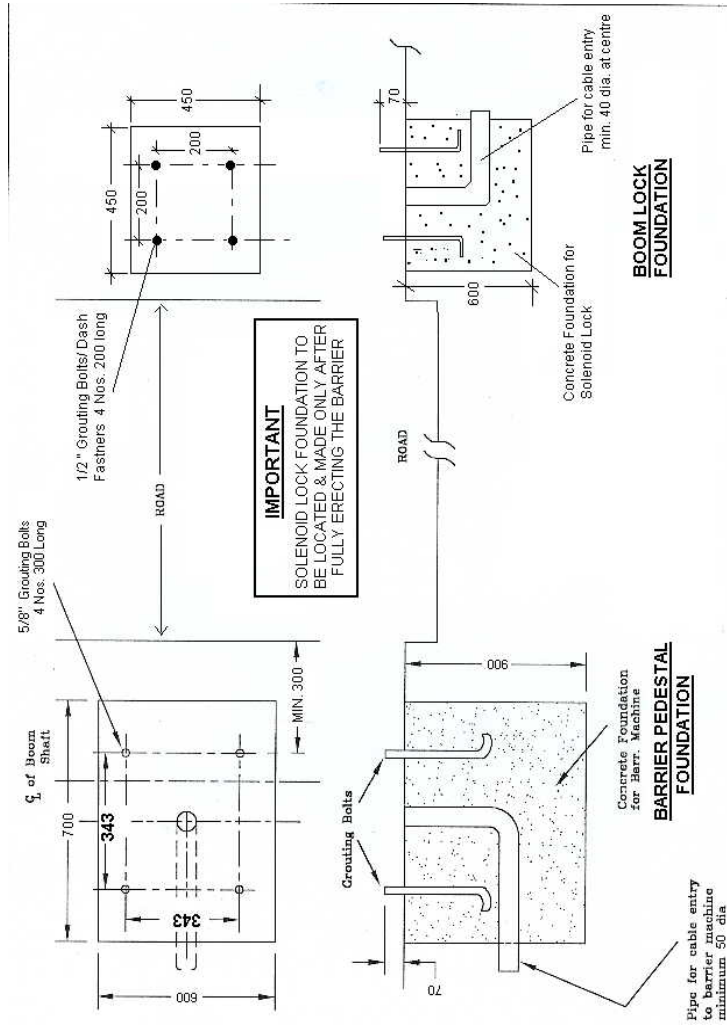


Fig 9 Foundation for electric lifting barrier

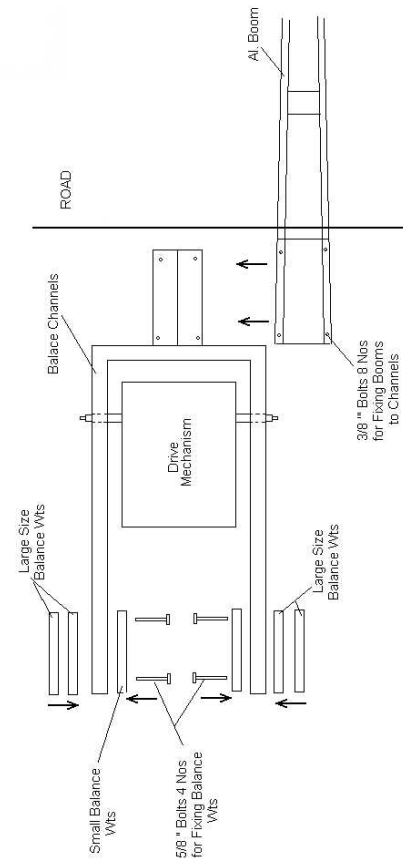
### **Fitting Mechanism**

- Lift mechanism box place on foundation, such that the four nos. grouting bolts protrude through the four nos. holes provided at the bottom of the mechanism box.
- Mechanism box is to be fixed such that the double ended shaft protruding from mechanism is parallel to the road and towards the road.
- Ensure verticality of mechanism box.
- Suitable packing may be provided below mechanism to achieve verticality if required.
- Tighten the four nos. nuts of the grouting bolts, along with washer & lock washer.

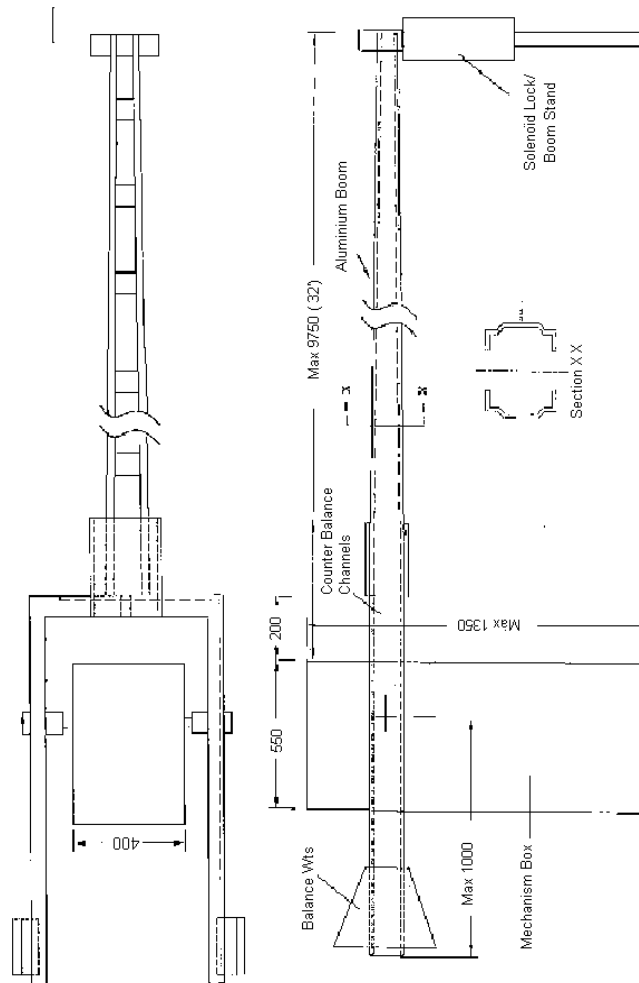
### **Equipment Assembly**

- The serial number of machine is marked on rear door. Similar serial number is also marked on counterbalance channels, aluminum booms and boom lock hook. Fit channel boom and boom hook on respective machine only to ensure matching.
- The counterbalance channels should first be mounted on the mechanism shaft on both sides and fixed together in front with the 3/8" nuts and bolts, along with the 3/4" nuts on the shaft.
- In the closed position of barrier, the counter balance channels should be so fixed such that the numbers punched on the channels are on top .
- After assembly of channels, the boom should be fixed by 8 nos. 3/8" bolts, followed by the balance weights.
- While boom is being installed, support the tip of the boom to avoid the damage of gear unit.
- The balance weights should be suitably adjusted until boom is properly balanced.

- This may be checked by ensuring that the effort required for opening and closing the barrier by crank handle or the current consumption is the same while opening and closing.



**Fig 10 (a) Barrier Assembly**



**Fig 10 (b) Barrier Assembly**

## **Solenoid Boom lock**

After completion of installation of the barrier machine, counter balance channels, boom hook, balance weight etc., mark the position of the boom tip support cum locking device and grout it at required position and height, so that boom falls in between the Y shaped fork, and the boom hook into the lock.

## **10. Adjustments**

### **10.1 Limit Switch**

- Two limit switches LS1 and LS2 are provided on rear box shaft to control auto stop in the fully open and closed position of the barriers.
- Three more limit switches with double contacts, LS3, LS4 and LS5 are provided to give back indications in fully open and closed positions.
- The limit switches are actuated by contoured cams fixed on boom shaft and position of these cams can be adjusted as follows :
  - Loosen the cam fixing screws using an allen key.
  - Adjust the position of cam as required, by rotating it on boom shaft.
  - Tighten one of cam fixing screws and check the position of cam by operating the barrier.
  - Tighten all fixing screws after cam position is properly adjusted.

*Fig No.11*

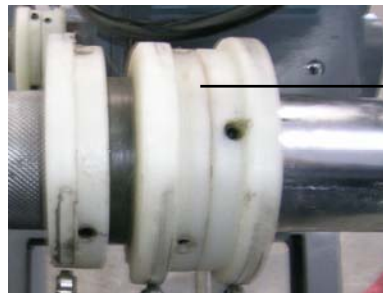
**8 Contact Circuit Controller with Top Roller Type Limit Switches actuated by Nylon Cams**

→ *Limit Switch*

## 10.2 Cam

A typical figure showing CAM is given on next page. Positions of the cams are to be adjusted as given below:

- The cam for LS1 is to be adjusted such that its contacts just break in the fully closed position of barrier.
- The cam for LS2 is to be adjusted such that its contacts just break in the fully open position of barrier.
- The cam for LS3 is to be adjusted such that its contacts just make in the fully open position of barrier.
- The cams for LS4 and LS5 are to be adjusted such that its contacts just make in the fully closed position of barrier.

*Fig No.12 :  
Nylon cams*

**Cams fully adjustable for full 360 deg for accurate adjustment of make/ break angle**

### 10.3 Friction clutch

The friction clutch is mounted on the input shaft of the gear drive unit and connected with the motor by a timing belt. An adjusting nut is provided on the clutch. Tightening this nut increases spring tension and hence slippage -torque. The slippage torque adjustment is to be done as follows:

- Completely loosen adjusting nut until gate fail to operate when motor is started and the clutch slips continuously.
- Tighten the nut in 1-1/2 turn stages and check for gate operation at every stage to locate the position of the nut where the slippage torque of clutch is just sufficient to drive the barrier.
- Tighten the adjusting nut by another ½ turn.



*Fig No.13: Friction Clutch*

- **Adjustment nut to be tightened/ loosened until Clutch Slips only when boom movement is obstructed.**
- **Check motor current is within limits when clutch is slipping**

## 10.4 Timing belt

The tension of the timing belt transmitting the power from the motor to the clutch system can be adjusted by adjusting the vertical position of the motor as follows:

- Loosen 4 motor fixing bolts.
- Adjust position of motor, until desired belt tension is achieved by providing suitable packing below motor.
- Re-tighten 4 fixing bolts.
- Ensure that motor is parallel to the clutch shaft to avoid excess wear of belts.



*Fig No.14 : Timing Belt*

- **Timing belt does not transmit power by friction (unlike V Belts)**
- **It should be left as loose as possible, without it slipping out while working. Tightened timing belt will wear out very fast.**



## **10.5 Boom Balancing**

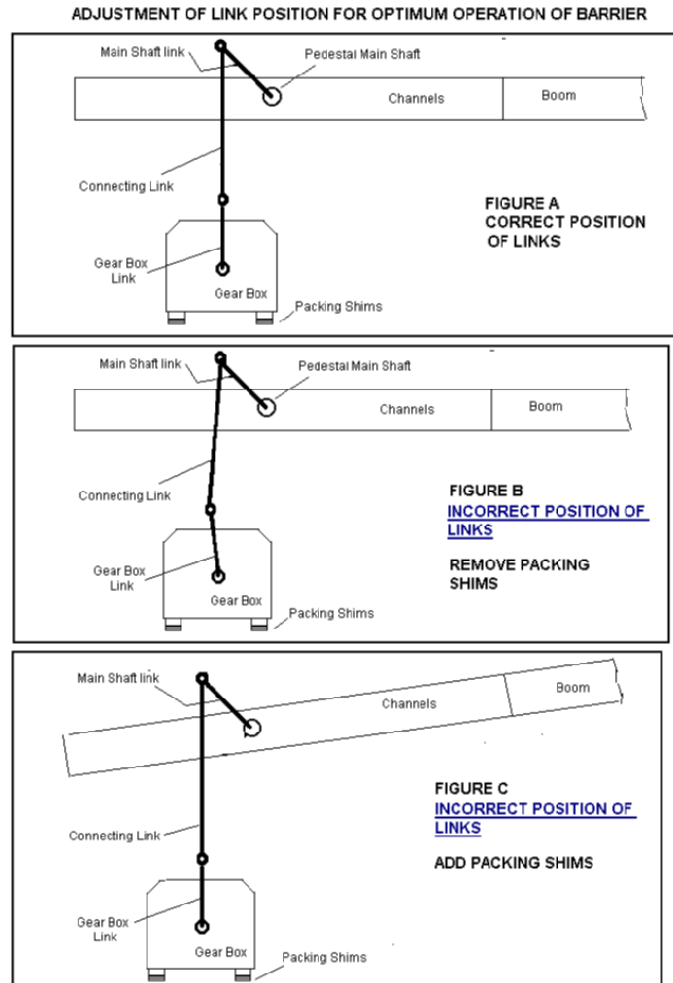
After installation check operating current while opening and closing of barrier, and adjust balance weights until current is almost the same in both directions.

However the balancing should be slightly towards the boom side, so that the boom tip rests properly on the boom stand rubber. To check this, with the boom in closed position, only small two finger force at the tip should be able to lift the boom for 30 – 40mm, until the boom locking device comes into action. On removing the finger force, the boom shall again close and rest on the rubber pads. This balancing will ensure proper working of the solenoid lock system

## **10.6 Connecting link position Adjustment**

The link system connecting the gear box with the main boom shaft is so designed as to provide a short idle stroke of gear link while opening, so that boom lock can operate before barrier actually starts moving up.

To achieve optimum operation, after installing the barrier, remove or add packing shims below the gearbox, until optimum position is achieved (refer Fig.No.15)



**Fig. No. 15 :Adjustment of Link position**

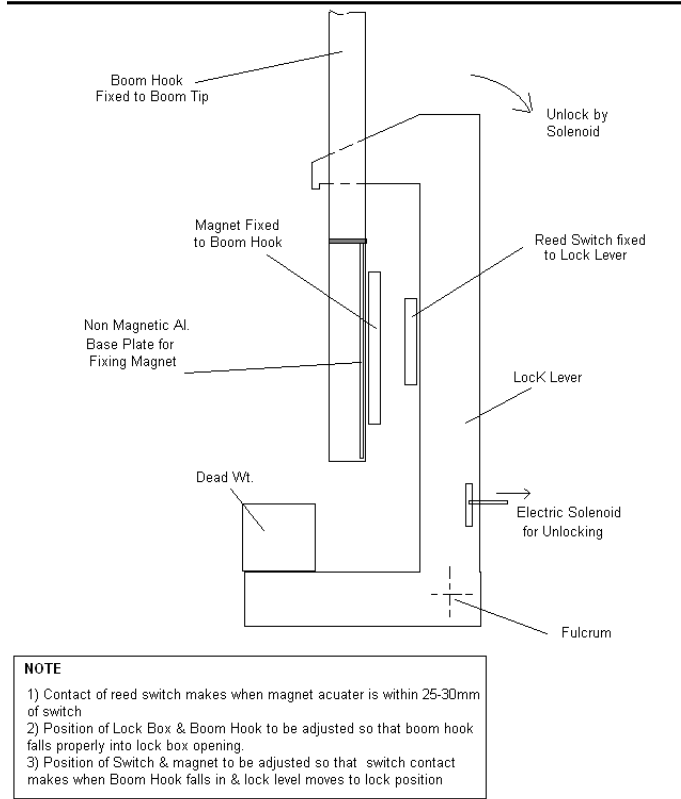
## 11. Boom Lock Proving Contact

A special boom lock proving contact has been provided in Electric Lifting Barriers which proves that boom hook is inside locking device and lock lever is in locked position. A special non-contact type magnetic proximity switch is used for this boom lock proving.

This contact proves the following:

- a) That the boom hook fixed to the tip of the boom has gone into the boom-locking device till the proper level, i.e. the boom is in fully closed position.
- b) That the solenoid operated boom locking lever has moved to the "Locked" position over the boom hook.

If either of these conditions are not met with the contact of the switch will not make.



**Fig. 16: Boom Lock proving Contact**

## **12. Post Installation checks and adjustments**

### **Barrier Pedestal and Boom**

- a) The pedestal, Boom and Balance weights should be fitted as per standard Assembly Drawing.
- b) Check that Pedestal is fitted properly (Water Level etc.) on the foundation, and fixing bolts fully tightened.
- c) Check that all the boom fixing bolts, boom joint bolts and Balance weight fixing bolts are tightened.
- d) Adjust the packing shims below the gear drive unit for optimum operation.
- e) Check that boom is properly balanced by adjusting the Balance weights.
- f) Check proper adjustment of friction Clutch.
- g) Check motor current during clutch slippage, and adjust clutch not if required.

### **Boom Locking arrangement**

- a) Check that the boom-locking hook falls properly into the cutout provided in boom solenoid lock cum boom rest stand.
- b) Adjust Solenoid lock position if required. Slots have been provided on base of locking arrangement, as well as between Box and Base, so that adjustment in both directions can be made.
- c) Adjust position of Proving contact arrangement.
- d) Firmly fix position of switches with adhesive after completing the adjustments.

### **Circuit Controller adjustments**

- a) Adjust the position of the cams operating the limit switches.
- b) The Switches LS1 & LS2 have been specially provided for controlling the cut off point of motor in the closed and open position.
- c) Switches LS1 ( NC Contacts) , LS4 & LS5 have been provided for signals. These should be used in Signalling circuit as desired.
- d) While adjusting these switches, care should be taken that adjustment is not too critical. i.e. the close position switch should make at about 2 degree instead of 0 degree, so that adjustment does not become critical.
- e) Circuit controller adjustment has to be made after installation of barrier.
- f) Ensure that all 3 fixing Allen bolts on each cam are tightened after adjustment.

### **Snubbing Resistor and Diode**

A Snubbing resistance has been introduced in series with the motor for following:

- i) Boom comes to rest more slowly and softly onto the boom end post while closing of barrier.
- ii) While Opening of barrier, solenoid lock gets more time for unlocking, and hence chances of lock sticking are greatly minimized.

This is achieved in the following manner:

- a) Resistance is 5-Ohm wire wound Resistor/ 10 Ohm Variable Resistor.

- b) The motor gets full voltage, from 90 deg (vertical) to about 25 deg position of the barrier through LS3 NC contact. The barrier operates at normal speed.
- c) The resistor comes into circuit where LS3 NC contact breaks. The voltage to the motor is lowered, thereby reducing the motor speed. The boom comes to a gentler stop when it hits the boom lock post.
- d) A diode is provided across the resistor, which shorts the resistor and barrier opens with full speed.
- e) The angular position at which the resistor comes into circuit to slow the motor can be adjusted by adjusting the cam which operates LS3. This angle along with the resistance ( In case of Variable resistor) may be adjusted after installation of barrier to achieve optimum results depending on boom balancing, input voltage etc.
  - o With input voltage of 23- 24 V DC, the snubbing resistor may be set at about 4-6 Ohms.
  - o Resistance for Lower Voltage setting should be lower, while for higher voltages, resistance value setting should be higher.
- f) In the latest installations, the snubbing resistor is being shorted out in manual mode by providing an additional NC contact in Auto/Manual selector switch.
- g) Details of circuit are given in Fig.7.

### **13. Modes of operation**

The lifting barrier have three modes of operation as given below:

- (a). With push button switch in case of 24V/110V power supply is available.
- (b). With hand generator (where this device is provided).

- (c). With direct crank handle on one boom at a time in case of power supply failure. The insertion of this crank handle disconnects the power supply to the motor and it is not possible to reconnect the power supply to the motor until the crank handle is withdrawn.

The operation of the barrier is as follows:

**A) Push button Electric operation**

- i) Turn Auto/ manual Selector switch on Hand generator to “ AUTO” position  
ii) Put Barrier Motor Toggle switch to ON position.

**For opening**

- Press OPEN push button, and keep it pressed.
- Barrier start opening and automatically stop in fully open position.
- Keep the button pressed for 2-3 seconds even after barriers reach open position, to ensure full opening.
- In case of low supply voltage, you may have to first put Motor Toggle Switch to “Off”, press open button for 1-2 second, and while keeping open button pressed, put motor switch to “On”. This will ensure that solenoid boom locks operate first before motor starts opening the barriers.

**For closing**

- Press CLOSE push button, and keep it pressed.
- Barrier starts closing and automatically stop in fully closed position.

- Keep the button pressed for 2-3 seconds even after barriers reach full closed position, to ensure full closing & locking.

#### **For stopping in the middle**

- Stop pushing the button, barriers stop in this position.

#### **Reversing**

After Stopping, press opposite button, after waiting for 2 second.

### **B) Hand Generator Operation**

Turn Auto/ Manual Selector switch on Hand generator to “MANUAL”

#### **For opening**

- i) First put Barrier Motor Toggle Switch (BMS) to OFF position, so that the full power generated goes directly to the solenoid lock coils.
- ii) Now rotate the crank of the hand generator in anti-clockwise direction, and build up some speed so that boom lock coils can operate to open boom locks. (Crank for About 2-3 second)
- iii) While continuing the cranking switch BMS toggle switches to ON position. The motors will also get power and barriers will start opening.
- iv) Continue cranking till barriers reach fully open position, and hand generator crank handle runs freely.



Note: Cranking Faster will move the boom faster, while cranking slower will accordingly slow down boom speed.

#### **For closing**

- i) Switch BMS toggle switch to ON position.
- ii) Rotate the crank of the hand generator in clockwise direction, and barriers will start closing.
- iii) Continue cranking till barriers reach fully closed position, and hand generator crank handle runs freely.
- iv) Do not stop cranking until hand generator crank runs freely.

Note: Operator should control cranking speed for desired time of operation and smoothness of operation.

#### **For stopping in the middle**

- Stop cranking barriers stop in this position .

#### **Reversing**

- After Stopping, start cranking in opposite direction.
- Before the barrier gate can reverse its direction of motion at any time (including when it stops automatically in the fully open and closed position), a delay of at least two seconds is required to avoid putting excess load on motor.

### **C) Emergency Direct Crank operation**

For this operation, the two barriers have to be cranked individually from each barrier pedestal.

- In case the barrier gate cannot be operated electrically due to hand generator/ cabling failure, manual operation is possible by using the direct barrier crank handle provided.

- For this operation, insert the barrier crank into the hole provided in the mechanism box rear door and thence into the shaft of the gear drive unit.
- For closing rotate handle clockwise direction.
- For Opening rotate handle anti-clockwise direction.
- As soon as crank is inserted, electrical operation is automatically cut off, and remains cut off till crank handle is removed.

In addition to the above Facility has also been provided for individual operation of the 2 barriers A and B if required as follows:

#### **14. Individual Barrier operation**

- This selection can be made in both types of operation viz. hand generator operation or push button operation.
- In case only barrier A is required to be operated, turn the barrier B selector switch provided to 'OFF' position.
- In case only barrier B is required to be operated, turn the barrier A selector switch provided to 'OFF' position.

#### **15. Parameters**

<b>Description</b>	<b>24V/110V</b>	<b>with</b>	<b>110AC</b>	<b>/110DC/</b>
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	<b>hand generator operated ELB</b>	<b>24DC ELB</b>
Rated voltage	75% to 125% of rated voltage	75% to 125% of rated voltage
Motor capacity	90Watt 1500 RPM PMDC	120 Watt 1500 RPM PMDC or 250 Watt 1400 RPM for 110 V AC
DC generator capacity	180 watt 1500 RPM PMDC	Not applicable
Power consumption	Approx 40 to 50 watt per barrier motor	Approx 70 to 90 watt per barrier motor
Operating time (opening / closing)	With in 10 seconds at rated voltage	With in 10 seconds at rated voltage
Max boom length	32 feet/ 9.75 meter	32 feet/ 9.75 meter

## 16. Maintenance

Maintenance procedure as per clause 14.3 and Maintenance schedule as laid down in Annexure –11 of SEM Part II should be followed. This may be modified by CSTE of the Railway to suit local needs.

Apart from this for trouble-free performance of electric lifting barrier periodic maintenance checks are recommended as follows: -

**Legends:**

W-Weekly, F-Fortnightly, M-Monthly, Q- Quarterly, HY- Half Yearly, Y-Yearly

S.N	Description	ESM	SE/JE	SS E
1.	Check the smooth operation of gate	W	M	Q
2.	Clean the inside and outside of mechanism, boom and channels	F	M	Q
3.	Check for auto stop of gate in the fully open and close position, adjust limiting switches if required	F	M	Q
4.	Check tightness of all fixing nuts and bolts of the mechanism base, gear box, motor, boom and counter balance channels and adjusting screws of the cams, which operate the limiting switches	W	M	--
5.	Clean inside the solenoid device and ensure that the lever falls to the lock position by gravity	F	M	--
6.	Check the operating current and voltage of Electric lifting barrier and ensure that they are in limit.	W	M	Q
7.	Check the clutch slippage torque - adjust if required	Q	HY	Y
8.	Check Timing belt tension for	Q	HY	Y

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S.N	Description	ESM	SE/JE	SS E
	both barriers and hand generator. Adjust if required			
9.	Check contacts of limit switches and contactors – clean if required. Replace limit switch/contactors if required.	Q	HY	Y
10.	Apply a little grease to the cam surfaces which operate the limit switches.	Q	HY	Y
11.	Check contact of boom lock proving switch. Replace if required	Q	HY	Y
12.	Megger the tail cable. Insulation should be more than 10 Mega Ohms	Q	HY	Y
13.	Replace the oil in gear unit of barrier and hand generator*.	HY	Y	Y
14.	Replace timing belt if worn out	HY	Y	Y
15.	Replace clutch plate if required	HY	Y	Y
16.	Oil the clutch slippage bush	HY	Y	Y
17.	Check for slippage of friction clutch – adjust if required	HY	Y	Y
17.	Check Wire Connections, contacts and cable wire connections	W	M	Q
18.	Check motor carbon tensions of carbon springs and clean the armature (for DC motor)	W	M	Q

S.N	Description	ESM	SE/JE	SS E
19.	Check machine foundation bolts, motor-fixing bolts, gearbox fixing bolts, pulleys of motor and gearbox, clutch assembly bolts	W	M	Q
20.	Check screws of ebonite cams of contacts	W	M	Q
21.	Balance the weights, test the E type lock provided to lock the lever lock plunger	F	M	Q
22.	Test the emergency cancellation key and check of oil in gear box	M	Q	HY
23.	Check NX switch	M	Q	HY
24.	Check core to earth insulation with 110 V megger from K rack	Q	HY	Y
25.	Test cable and motor insulation	Q	HY	Y
26.	Clean neutral and contactor relays	Y	-----	---- -

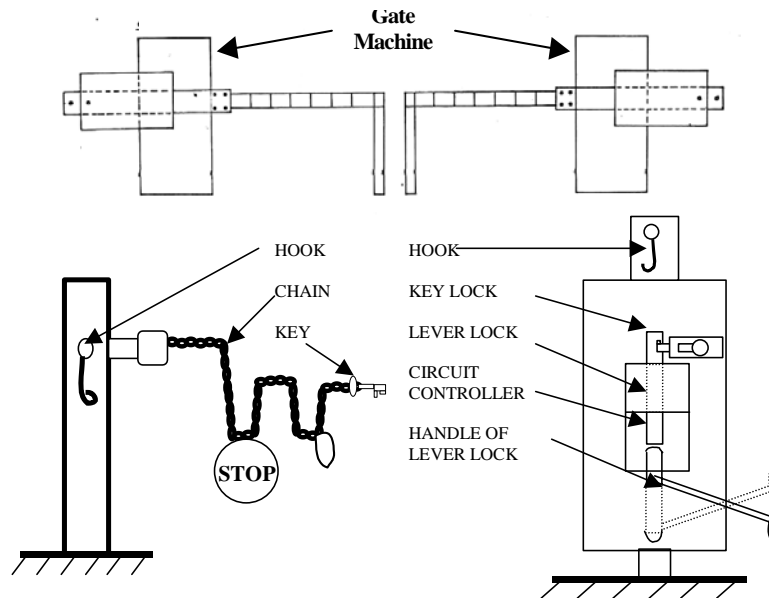
\*Old oil is removed from the bottom of the gear unit by opening the bottom plug. New oil is filled from the top of the gear unit by opening the top plug provided. Use gear oil SAE 90 or equivalent. Quantity 1.5 litres in each barrier and 0.3 litres in each hand generator gear box.

### 17. Interlocked key chain working

- An independent stand by emergency key chain interlocking arrangement is provided for regulating rail/road traffic in case of damage/mechanical failure of gate machine.
- A post of about 1meter (i.e. boom height from rail level) is provided at one side of the road. A metallic chain is fixed to this post. A sheet metal round board with legend "STOP" in red (with luminous paint) on white background is provided in the middle of this chain. A loop with E-type lock key is rigidly fixed to other end of the chain.
- On the other side of the road, a lever lock with an E-type is provided on a post. The E-type lock plunger normally locks the lever lock plunger in normal position. The post at this side has a hook. In which a chain with a key is hanging to lock the lever lock.
- When booms are immobilized due to damage or any other reason, chain is thrown across the road. The loop in chain is then engaged in the hook on lever lock post and E-type lock key is inserted in E-type lock and turned. Turning of key releases plunger of lever lock, which can now be reversed.
- The reversing of lever enables transmission of slot of cabin/gate lodge. Once reversed, lever remains locked till slot for opening gate to road traffic is received.
- When due to necessity, emergency chain interlocking is used, signals can assume only caution aspect even if other conditions for clear aspect exists.
- Thus traffic can be run with the help of emergency key chain interlocking in interim, albeit in restrictive caution aspect, till barrier working is restored.
- The arrangement is useful in CLS. (colour light signals) as shown on next page.

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1. The length of chain will be according to width of the road.
2. Electric lever lock and circuit controller combined 200-mm stroke with one proving contact conforming to Drg. No. RDSO SA 22701 IRS-23.
3. Chain signal steel galvanised 2 SWG 1 7/16 x 7/8 inches outside dia.
4. Stop board – 300-mm dia 3 mm thick, galvanised steel plated with fluorescent red paint back ground with stop in white letters.



*Fig. 17 Interlocked Key chain working*

## 18. Troubleshooting

- **Barrier fails to operate for opening or closing**



- Check power supply at motor terminals. Check motor connections, contactor and carbon. If no supply, then check supply at the control panel end and restore supply.
- Check power at Contactor. If no supply, change MCB.
- Check power supply after “STOP” button. If no supply, change contact of stop button.
- Check power supply after the crank handle (CHS) switch. If no supply, clean limit switch.
- Check power supply after timer contact. If no supply change timer.

■ **Barrier Opens But Fails To Close**

Check in sequence keeping close button pressed.

- Check supply after close button NO contact. If no supply, change contact of close button.
- Check supply after limit switch LS1. If no supply, clean/adjust limit switches contacts.
- Check supply after back contact of OPEN switch contactor. If no supply, clean contact of contactor.
- Check supply across coil of CLOSE switch contactor. If supply is present but contactor does not operate, change coil of contactor.

**■ Barrier closes but fails to open**

Check in following sequence, keeping open button pressed:

- Check supply after open button NO contact. If no supply, change contact of open button.
- Check supply after limiting switches LS2. If no supply, clean/ adjust limit switch contact.
- Check supply after back contact of CLOSE switch contactor. If no supply, clean contact of contactor.
- Check supply across coil of OPEN switch contactor. If supply is present but contactor does not operate, change coil of contactor.

**■ Contactors Operate But Motor Does Not Operate**

- Check that after contactor operates, supply is available between appropriate terminals. If no supply, clean contactor contacts.
- Check that motor running winding and starting winding are connected between appropriate terminals. If not, correct motor winding.
- Check motor capacitor.
- Check motor.

**■ Motor Operates But Barrier Does Not Move**

- Check timing belt. Adjust/ replace as required.
- Check for any obstruction to boom or counterbalance channels, by operating manually. Remove obstruction.
- Check for slippage of friction clutch. Adjust if required.

## **18.1 Miscellaneous troubles and their remedies**

- If for some reason the motor is rotating in the wrong direction i.e. barrier goes up when close contactor is operated and vice versa, interchange wires of terminal nos. 1 & 2 in mechanism box.
- If Diodes are not working as per detailed above (i.e. if boom lock is operating while closing and not while opening) reverse the diode.
- If for any reason generator motor is rotating in wrong direction, rotating generator crank clockwise is opening the barrier, interchange generator motor terminals.
- In case clutch is observed to be slipping and the barrier is not moving, check that there is no physical obstruction to boom or counterbalance channels, before tampering with clutch adjustment.

## **19. Do's & Don'ts**

### **19.1 Do's**

- Fit the boom and boom hook on the respective machine only, to ensure matching.
- For optimal and trouble free working of the lifting barriers, the boom should be carefully balanced, as the motor provided cannot be overloaded for operating unbalanced boom.
- Circuit controller adjustments should be made after installation of the barrier. Ensure that all three fixing allen bolts on each cam are tightened after adjustment.
- After every accident/repair, adjust the cam if required.
- Care should be taken that the snubbing resistor value set is not so high that the motor fails to operate with any slight drop in input voltage.

- After fitting and testing of boom lock and its accessories, apply a little adhesive to the fixing nuts of switch and magnet to ensure that they do not get loose with vibrations.
- After installation the working of the proximity switch should be checked by continuity meter to ensure proper functioning.

## **19.2 Don'ts**

- Do not try to adjust the angle of boom lock lever.
- Do not tighten the Timing belt fully , left it a little loose as it does not transmit power by friction (unlike V belts).

## **20. Inspection of interlocked LC gates**

- The approach road should be in level.
- The gate equipments should be there as prescribed in the working rule.
- It should be ensured that the “Whistle Board” and “Warning Board” are provided.
- The telephone communication is in proper working order.
- The working instructions of level crossing gate is in local language besides Hindi and English.
- The height gauge should have proper clearance and should be located at a minimum of 8 (eight) meters from gate post in case of electrified section.
- Provision of Speed breakers on either side of Level crossing with in Railway boundary, preferably at a distance of 20 meters from gate.
- Ensure that boom locking is effective.

**21. Tools**

- |                       |       |
|-----------------------|-------|
| i. Multi meter        | 1 No. |
| ii. Megger            | 1 No. |
| iii. Spanner set      | 1 No. |
| iv. Pliers            | 1 No. |
| v. Screw driver Set   | 1 No. |
| vi. Allen key         | 1 No. |
| vii. Hammer ( 5 Lbs.) | 1 No. |
| viii. Chisel          | 1 No. |

**22. Consumables**

- i. Timing Belt, 285 L, 20 mm width (make - Mitsubishi/Syncrostar)
- ii. SAE oil (Grade 90 or 100)
- iii. Cotton waster 'A Grade'
- iv. Lamps

