REVIEW HANDBOOK ON
ELECTRIC LIFTING BARRIER WITH
EMERGENCY SLIDING BOOM

CAMTECH/S/PROJ/2014-15/HB-ELBESB/3.0
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Indian Railways
Centre for Advanced Maintenance Technology
MAHARAJPUR, GWALIOR – 474 005
This handbook is prepared with the objective of disseminating knowledge to maintainer & construction signalling staff of Indian Railways for better way of maintenance and installation of electric lifting barrier with emergency sliding boom to minimize signal failures and maintain the punctuality of the trains.

This handbook covers detailed procedure of installation, maintenance, adjustment, replacing of parts, do’s and don’ts etc.

I hope that this handbook will be very useful to signalling field staff.

CAMTECH
GWALIOR
Date: 25.9.2014

A.R.Tupe
Executive Director
Preface

On Indian Railways failures of electric lifting barriers affects the punctuality of trains. CAMTECH is continuously putting efforts in the field of documentation and upgradation of information on maintenance practices.

This maintenance handbook has been prepared to help the maintenance and construction staff for maintenance, installation of electric lifting barrier in better way to minimize the signal failures.

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

We are sincerely thankful to Shri Satendra Kumar, Dy. C.S.T.E./Patna/EC Railway, Shri Narendra Singh, D.S.T.E./GWL/NCR, firms M/s Heidz Indian Pvt. Ltd, New Delhi & field personnel who helped us to prepare this maintenance handbook.

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

CAMTECH
GWALIOR
Date: 25.9.2014

D.K.M. Yadav
DIRECTOR(S&T)
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ISSUE OF CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows:

CAMTECH/S/PROJ/2014-15/HB-ELBESB/3.0.# XX date-----------------------------

Where “XX” is the serial number of the concerned correction slip
(Starting from 01 onwards)

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ELECTRIC LIFTING BARRIER
WITH EMERGENCY SLIDING BOOM

SECTION-I – GENERAL

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

Electric 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 latest specifications:

- Lifting barrier is robust and operating mechanism is protected against unauthorized 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 within 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 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.
SECTION –II

A) 110 VOLT AC ELECTRICALLY OPERATED LIFTING BARRIER WITH MOTOERIZED LOCKING AND CIRCUIT CONTROLLER (In place of limit switch) (Global Devices make)

1. General Information:
   - Electrical lifting Barrier manufactured by GLOBAL DEVICES (as per specification
   - no. RDSO/SPN/208/2012 provides with a safe, reliable and smooth operation of simultaneous closing and opening of both the barriers fixed at both sides of railway level crossing.
   - The electric lifting barrier works on 110 V AC and can easily be operated by any ordinary person like a watch man or a gate man. All indications and controls are provided on the panel which will be placed inside a remotely situated cabin / hut.
   - As a very special feature the Control Panel is equipped with LED light barrier which glows when barrier is locked in the horizontal position. The light ensures that the barrier has been actually locked. This feature has been developed keeping in mind the hostile climatic conditions when visibility is low or physical check becomes difficult.
   - In case of any fault in the system or power failure, a provision of hand cranking of each barrier has been provided.

2. POWER SUPPLY REQUIREMENT:
   The Electric Lifting Barrier can be operated on 110 V AC

3. OPERATION OF ELECTRIC LIFTING BARRIER
   (Normal Mode-Power Available)
   - Ensure and connect power supply 110 V AC.
   - Put the Mode selector switch to ON position as given below in fig no.1.
   - The 'Power' indicator LED (Amber) will glow, thereby indicating that power is available.
   - For closing the Barrier together, press the CLOSE push button (YELLOW) continuously till the Barriers come down and get locked in the locking device.
   - As soon as the Barriers reach the closed position AMBER LEDs glow and on getting locked GREEN LEDs will glow indicating Boom lock proving has taken place.
   - In case there is malfunction in any one or both the locking devices and locking does not take place then the respective Green LED for the connected barrier will not glow. However if the Amber LEDs are glowing then the emergency push button can be pressed after physical verification of locking at both the lock posts.
   - When the Barriers are in the horizontal position press the OPEN Push Button (Green) continuously, both the barriers will start opening till they reach in the vertical position. Motors will automatically cut-off once the desired vertical angle has been achieved.
3.1 OPERATION OF ELECTRIC LIFTING BARRIER:  
(During Power Failure)

- Put the Main power switch to **OFF** position.
- Insert the Crank handle provided with the Barrier pedestal
- Now crank in the anti clock wise direction to open the Barrier. First the lock will open and then the barrier will start rising.
- Crank in the clock wise direction till the barriers are fully closed. Keep cranking till the Locking takes place.

![Fig. 1 Operating Panel](image)

4. INSTALLATION

FOUNDATION AND GROUTING.

The foundation on which each pedestal has to be mounted should be first made ready. The foundation bolts should be tightly fastened to the pedestals. All barriers are suitably marked with a unique identification numbers which match as per the drawings provided. Grouting of pedestals should be strictly done with the help of a water level indicator so that the barrier is in the most horizontal level. Improper alignment will hamper with the smooth functioning of the barrier. A unique identification number of machine is marked on rear door. Fit the boom & boom hook on the respective machine only, to ensure matching. The counter weights, circular stop board & control panel are interchangeable.

CABLE REQUIRED:

- 12 core cable size 1.5 sq mm between each barrier machine & relay rack.
- Min. 12 core cable size 1.5 sq mm between each barrier machine & relay rack for circuit controller contacts & boom light.
- Min.12 core cable size 1.5 sq mm between each barrier machine & its corresponding boom lock fixed at the other end of road.
- Necessary cables for road signal audio warning.
- Necessary cable between barrier control panel and relay rack, minimum 16 core depending on Railway circuit.
MOTOR

The motor provided is **110 V AC reversible**.

If for some reason the motor is rotating in the wrong direction i.e. barrier goes up when close contactor is operated & vice versa, interchange wires of terminal nos. 1 & 2 in mechanism box.

The control circuit for operating motor contactor coils should also take care of following:
- The 2 contactors should be interlocked so that when one is picked up, the other does not pick up.
- If either of the 2 crank handle cutout switches (for the 2 barriers of a set) is operated, electrical operation of both the barriers of the set should be cut off.
- The boom lock proving contact (which proves that the locking shaft is in the locked position) should be suitably wired up in the barrier.

MOTORISED LOCKING ARRANGEMENT

The motorized lock works on 110V AC supply.

Following points should be taken care of in the Railway Circuit, for giving feed to the motor.

1. Motorized lock gets feed only when the boom is at about 5 deg from the horizontal.
2. The motor activates when the boom plunger presses the Boom detection Lever in the locking box and thus locking takes place.
3. The motor works in the reverse direction while opening and thus opens the Lock.
4. In case of power failure, motorized locking will be accomplished manually with the help of locking/unlocking handle.

In this system locking takes place when the locking shaft crosses the cavity in the plunger.

Prior to the plunger entering the locking system the locking SS shaft is completely inside the locking box.

When the plunger enters the locking box the tip at the end of the plunger hits the Boom Detection Lever of the CC 9 CC9 rotates marginally and a switch is made which in turn operates the motor which throws the locking rod out by more than 50mm through a geared mechanism. This movement of the locking rod rotates CC 11.
With the movement of the rod in the forward direction CC 11 is also released in to the slot provided in the SS rod.

CC11 gives positive locking indication on release and CC10 gives feed to the barrier pedestal motor to operate.

This arrangement works in sequential operation of the locking motor and pedestal motor. When the open switch is pressed, current flows in the reverse direction and so does the motor taking the rod inside the box making clear way for the plunger to move out. When the open push button is pressed
feed goes to the Locking Motor only at 5 deg to the horizontal and activates the locking motor sliding back the SS rod inside the locking box.

**BOOM LIGHT**

The boom light is **LED** based & works on 110V AC.

### 4.1 INSTALLATION OF PEDESTALS AND BOOM BALANCING:

During installation, following process should be followed:

- Mount the pedestal on the prepared concrete foundation.
- Mount boom link on the shafts in the horizontal position and fasten nuts.
- Connect the four sections of the boom together by matching identification number of the sections.
- Mount Boom on the Boom Link and fasten nuts.
- Fasten counter weights immediately.
- Balance the boom with the counterweights by shifting the counter weights in the forward and backward direction.
- Feel the balance by lifting the Boom at the locking end by two fingers. The boom should slightly go up by 2 to 4 cms. and come back and rest on the rubber pads.
- Mount the locking plunger at the tip of the Boom as per the hose provided on the Boom.
- Fix the locking pedestal in such a way that the locking plunger enters the locking device smoothly and freely.
- Mount the accessories like “stop disc” etc.

### 5. ELECTRICAL ADJUSTMENTS

Although the circuit controllers are factory fitted still fine adjustments may be required for CC-1 TO CC-8 as the base level at various sites may vary. Method of adjustment is given in detail further.

![Fig. 4 Circuit Controller](image-url)
BOOM LOCK PROVING CONTACTS:

The boom Lock Proving contact has been designed in such a way that the AMBER Colour LED lamp indication situated in the main control panel at for respective barriers glow and indicate that the plunger has entered the locking device, and as the locking shaft slides and moves forward to lock, the GREEN Colour LEDs glow confirming that the locking has been achieved.

MOTOR OVERLOAD PROTECTION:

Although a mechanical clutch has been incorporated with the motor to withstand any physical obstruction which may occur during operation yet an MCB of 16 Amp rating with built in Bi-metallic contacts in the barrier pedestal has been introduced as a second line of defense.

It therefore means that the motor will be safe even in case of failure of the mechanical clutch in case of any obstruction.

6. INSTRUCTION FOR OPERATION OF CONTROL PANEL

1. RED COLOUR emergency push button which is to be pushed in case any or both of the booms do not get locked (GREEN indicators do not light up). It will be used only after physical verification of locking at both the lock posts.
2. LED INDICATOR (AMBER) LAMP which glows when power supply is available. NO GLOW will indicate power failure and hand cranking has to be used.
3. SELECTOR SWITCH which allows you to make power ON or OFF.
4. LED INDICATOR (AMBER) LAMP which glows when the plunger of the BARRIER A has been detected. Meaning thereby that the barrier has reached its Horizontal position.
5. YELLOW COLOUR PUSH BUTTON which has to be kept pressed till the barriers reach the horizontal position.
6. LED INDICATOR LAMP (GREEN) which glows when the BARRIER ‘A’ has been securely LOCKED. The Lamp will turn OFF as soon as the Lock has been opened.
7. LED INDICATOR (AMBER) LAMP which glows when the plunger of the BARRIER B has been detected. Meaning thereby that the barrier has reached its Horizontal position.
8. GREEN COLOUR PUSH BUTTON which has to be kept pressed till the barriers reach the fully open position.
9. LED INDICATOR (GREEN) LAMP which glows when the BARRIER B has been securely locked. The Lamp will turn OFF as soon as the Lock has been opened.

7. Adjustments of Circuit Controller, Friction Clutch Assembly and Timing belt:

• CC1 has been provided on the Main shaft to close the gate from 90° to 05° and control the auto stop in the fully closed position of the barriers.
• **CC2** has been provided on the Main shaft to open the gate from 0° to 85° and control the auto stop in the fully open position of the barriers.

• **CC3** have been provided on the Main shaft to control the Boom light and is available from 0° to 5°

• CC4 is available from 85° to 90° and has been provided on the Main shaft for gate indication for railways.

• **CC 5** is available from 85° to 0° and has been provided on the Main shaft for hooter.

• **CC 6 & 7** has been provided on the Main shaft for Railways and are available from 0° to 5°

• **CC 8** is spare.

The **circuit controller** is actuated by copper rings and carbon brushes fixed on the boom shaft and the position of these rings can be adjusted as follows:

i. Loosen the fixing Allen screws using an Allen Key.

ii. Adjust the position of the CC as required, by rotating it on the boom shaft.

iii. Tighten one of the fixing Allen screws, and check the position of the copper ring by operating the barrier.

iv. Tighten all fixing Allen screws after desired position of the copper rings is properly adjusted

**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 the slippage torque. The slippage torque adjustment is done as follows:

i. Completely loosen adjusting nut until gate fails to operate when motor is started, and the clutch slips continuously.

ii. 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.

iii. Tighten the adjusting nut by another 1/2 turn.

In case clutch is observed to be slipping and the barrier is not moving, please check that there is no physical obstruction to boom or counterbalance channels, before tampering with clutch adjustment.

**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:

i. Loosen the 4 motor fixing bolts.

ii. Adjust the position of the motor, until desired belt tension is achieved, by providing suitable packing below motor adjusting the motor.
iii. Re-tighten the 4 fixing bolts.
iv. As the timing belt does not transmit power by friction (unlike V Belts) it should be left a little loose & not tightened fully.

8. MAINTENANCE:

The entire design concept of the equipment is that of a Sealed System Design with self lubricating units and materials. However some periodic maintenance checks are recommended as follows:

FORTNIGHTLY MAINTENANCE

a) Check for smooth operation of Barrier.
b) Clean the inside & outside of mechanism, boom & channels., and Hand Generator
c) Check for auto stop of Barrier in the fully open and closed position. Adjust circuit controllers, if required.
d) Check tightness of all fixing nuts and bolts of the mechanism base, gear box, motor, boom & counterbalance channels & the adjusting screws of the circuit controllers.

MOTORISED LOCKING SYSTEM

Although almost no maintenance is required for the motorized locking system still following check may be undertaken in case of failure.

• Check loose connection of wires at the terminals in the CC9, CC10, CC11 and the motor.
• Check the alignment of the SS Rod.
• Check the Nylon Bushes over which the SS Rod Travels.
• Independently check the tightness of CC9, CC10, CC11.
• Check the pinion screw mounted over the main shaft of the motor.
• Check the motor independently.
• Never grease or oil the SS shaft.

PRECAUTIONS TO BE TAKEN
• No Lubrication is required.
• Please ensure that the cover of the locking mechanism is properly replaced after the routine check as it makes it all weather proof.
• While installation, please ensure that the top end of locking arrangement should be at the same height as of the main shaft of the pedestal.

QUARTERLY MAINTENANCE
a) Check clutch slippage torque. Adjust if required.
 b) Check Timing Belt tension for both barriers & Hand Generator. Adjust if required.
 c) Check contacts of copper ring with carbon bushes of all circuit controllers.

ANNUAL MAINTENANCE
a) Replace the oil in the barrier gear unit. 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.
 b) Use gear oil SAE 90 or equivalent.
 c) Qty. 1.5 liters in each barrier gear box.
 d) Replace Timing Belts if worn out
 e) Replace Clutch plate if required.
 f) Oil the clutch slippage bush.

9. PROCEDURE FOR REPLACEMENT OF PARTS and PERIODICITY OF ROUTINE REPLACEMENT OF PARTS:

The General items which may be required for replacement periodically are:
a) Limit Switch b) Gear Box Oil, c) Selector Switches, d) Push Button Switches, e) Motor, f) Timing Belt, g) Carbon brushes, h) Boom (In case of any accident)

Procedure for Replacement:

1) It should be ensured that before conducting any operation the Power supply to the system should be cut off.

2) Gear Box Oil - At the bottom of the Gear Box a locking screw will be found. Unscrew the screw till the time it comes off the Gear Box. Place a container beneath the Gear Box to collect the used Oil.

3) Simultaneously also open another screw located at the top of the Gear Box. Once all the oil is drained out plug the bottom screw in fully tight position.

4) Fill up the gear box with 1.5 Litres of New Oil by the help of a funnel. Tighten the top screw and check for any leakage.

5) Selector Switch - Selector Switch can be removed by the help of simple screw driver by loosening the screws which hold the switch to the panel.
6) **Push Button Switch** - Push Button Switch can be removed with the help of screw driver.

7) **Timing Belt** - Timing Belt should be carefully examined for any wear and tear in all periodical checkups. In case the belt has to be replaced it can be easily taken off the Pulleys manually.

8) **Boom** - the boom is consisting of 4 sections. It shall be dismantled section wise by unscrewing the nut & bolts.

### Periodicity of Replacement

1) The spring loaded Carbon Brushes are meant for permanent usage. However the contacts made by the carbon brushes need to be closely watched so that the circuit controller operation is not affected.

2) This should be watched every three months.

3) Check Gear Box for any leakage of oil every three months. Oil has to be replaced after 1 Lac operation or One year whichever is earlier.

4) For rest of the item periodic maintenance of 6 months is sufficient.

10. **Tool required for installation of electric lifting barrier:**

   The Following Tools are required to during installation of the Lifting Barrier

   - Spanner 10 x 11
   - Spanner 12 x 13
   - Spanner 17 x 19
   - Allen Key 2.5 mm
   - Allen Key 4 mm
   - Allen Key 8 mm

11. **Electrical Connections:**

   Electrical cabling & connections have been totally simplified, and minimal cabling is required, as follows:

   i) A minimum 12 core cable size 2.5 sq mm between generator & each pedestal.

   ii) A minimum 12 core cable size 2.5 sq mm between each motorized lock & respective barrier pedestal.

   iii) Cabling as required for Signaling circuits with 2.5 sq mm, interlocking etc. as per Railway Circuit.

   iv) 110 V AC Supply to control panel with cable size 2.5 sq mm for power ON/OFF push button for normal operation.
12. Do’s and Don’ts

Do’s

- Strictly follow the instructions and procedure serially for Installation of Pedestal & boom balancing as described.
- Electrical connections to be done as per instructions given in the handbook.
- Do all the periodic maintenance regularly.
- Ensure to cutoff power supply before replacing any or doing periodic maintenance.
- Always use recommended spare parts and Gear Oil.
- Strictly follow the procedure for replacement of any part and periodicity of replacement as described in the handbook.
- Always use proper tools as detailed.
- Always use cable size and no. of cores as described in the manual.

Don’ts

- Never grease or oil the SS locking shaft.
- Do not mount the counter weights before mounting of boom.
- Do not exceed the prescribed voltage limits.

B) 24 V/110V DC ELECTRICALLY OPERATED LIFTING BARRIER WITH MOTORIZED LOCKING AND HAND GENERATOR (M/s Global Devices make)

1. WORKING PRINCIPLE:


Main differences in 24V/110VDC Electrically operated lifting barrier in comparison with 110V AC Electrically operated lifting barrier are as detailed below.

2. Power supply requirement:

The Electric Lifting Barrier can be operated on 24 V DC or 110 V DC.

3. OPERATION OF ELECTRIC LIFTING BARRIER:
(Normal Mode-Power Available)

- Ensure and connect power supply as available: - 24 V or 110 V DC.
- Put the Mode selector switch to AUTO position. Ref Fig 1 below.
- The 'Power' indicator LED will glow, thereby indicating that the circuit has been charged.
3.1. **OPERATION OF ELECTRIC LIFTING BARRIER**  
(Hand Generator Mode-During Power Failure)

- Put the Mode selector switch to **MANUAL** position.
- To close the barriers rotate the lever on the main control panel in clock-wise direction till both the barriers reach the horizontal and locking takes place.
- To open the barriers rotate the lever on the main control panel in anti-clock-wise direction.
- Both the Locks will open first and the Barriers will start rising.
- Keep cranking till the required position is achieved.

3.2. **OPERATION OF ELECTRIC LIFTING BARRIER**  
(During Power Failure and failure of hand generator)

- Insert the Crank handle provided with the Barrier pedestal
- Now crank in the anti clock wise direction to open the Barrier. First the lock will open and then the barrier will start rising.
- Crank in the clock wise direction till the barriers are fully closed. Keep cranking till the Locking takes place.

**Motor:**

The motor provided is **PMDC 2 wire motor**.
4. **MOTORIZED LOCKING ARRANGEMENT:**

   The motorized lock works on 24 V/110 V DC supply.
   - In case of power failure motorized locking will work normally both through the hand generator or direct cranking.

**Boom Light:**

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

5. **Adjustments of Circuit Controller:**

   Adjustment of Friction Clutch Assembly and Timing Belt is same as in 110 V AC Electrically Operated Lifting Barrier.
   - **CC 1 (85 to 05)** & **CC 3 (05 to 0)** have been provided on the Main shaft to control the auto stop in the fully **closed** position on the barriers as also provide back indication.
   - **CC 2 (05 to 85)** has been provided on the Main shaft to control the auto stop in the fully **open** position on the barriers as also provide back indication.
   - **CC 4 (05 to 85)** have been provided on the Main shaft to control the Boom light auto stop in the fully **open** position.
   - **CC 5** has been provided on the Main shaft to make **90 to 85**.
   - **CC 6** has been provided on the Main shaft to make **85 to 0**
   - **CC 7** has been provided on the Main shaft to make **0 to 05**
   - **CC 8** has been provided on the Main shaft to make **0 to 05**.

   CC5, CC6, CC7, CC8 have been provided as additional contacts for Railway use.

```
CC 1
CC 8

CCS 1 TO 8
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![Fig. 2 (Circuit Controller)](image-url)
SECTION -III

A) 110 V AC ELECTRICALLY OPERATED LIFTING BARRIER WITH SOLENOID LOCKING (without hand generator). (M/s Heidz make)  
(As Per RDSO Specification no. RDSO/SPN/208/2012)

1. BRIEF DESCRIPTION OF THE SYSTEM

Each Lifting Barrier System consists of the following Major parts.

PEDESTAL WITH COUNTERBALANCE CHANNELS, WEIGHTS & BOOM

The 2 units are provided on either sides of the Rail Track

The pedestal houses the Gear Box, Motor, Hand Crank arrangement, circuit controller etc. in a weather proof cabinet. On the output shaft of the pedestal are mounted the counterbalance channels with the boom on one side & the counter weights on the other side.

By giving power supply to the motor, the motor rotates the gear box (through a clutch) which in turn moves the counterbalance channels from Horizontal (closed) to vertical (Open) positions & vice versa.

Feed to the motor is automatically cut off when boom reaches fully open or closed positions, by means of the circuit controller switches. Make/ Break points of these switches are individually site adjustable.

![Fig.1: Interior of pedestal](image-url)
NEW SOLENOID BOOM LOCKING ARRANGEMENT:

One such unit is provided for the tip of the boom for each pedestal.

It consists of a locking lever which with pin & bearing to provide a fulcrum. The lever is kept in locked vertical position by a suitable dead weight & end stop. Movement to unlocked position is by means of an electromagnet.
This arrangement locks the tip of the boom in the fully closed position, and also provides multiple magnet switch detection contacts for positive boom lock proving.

Locking is by gravity while unlocking is by energizing a solenoid provided to move the locking lever to the unlocked position.

A backup mechanical limit switch has also been added in the new design of boom locking. Contact of this switch along with a special emergency button on Panel can be used to bypass the main magnet switch detection contacts in case of malfunction of the latter.

---

**Fig.4: New Solenoid Lock**

**Fig.5: Boom lock**
CONTROL PANEL:

This unit is provided in the Gate Lodge/ Cabin.

The panel face has 2 buttons (Open & Close) along with 1 no. emergency Operation Button.

2 green indicating lamps are provided to show closed & locked position (from Magnet Switch) of both barriers individually.

Similarly 2 amber indicating lamps are provided to show the closed position (from Limit Switch) of both barriers individually.

Another amber/ red indicating lamp shows when input power supply is available.

Necessary contactors & relays as per panel circuit given in following pages are also fixed inside the control panel.

---

2. POWER SUPPLY REQUIREMENTS, CABLELING REQUIREMENT & ELECTRICAL CONNECTIONS:

2.1. Power Supply Requirements

110 V AC power Supply minimum 5 amps up to hand generator cum panel unit.
2.2. Cabling Requirements:

Electrical cabling & connections have been totally simplified, and minimal cabling is required, as follows:

i. A minimum 9 core cable between panel unit & each pedestal, for the barrier operation (additional cores required for signalling circuits.)

ii. A minimum 12 core cable between each solenoid lock unit & respective barrier pedestal.

iii. Cabling as required for signalling circuits, interlocking etc. as per Ry. circuit. approx. 20 – 25 cores from each pedestal to relay rack.

Note: Cable size should be adequate, such that the voltage at the solenoid terminals on load should not fall below 85-90 V for the 110 V AC barriers.

2.3. Electrical Connections:

Connections which are made for operating the barrier:

- Connect Terminals 1 to 4, of Barrier A to respective terminals A1 to A4 provided in Control Panel.
- Connect Terminals 1 to 4, of Barrier B to respective terminals B1 to B4 & provided in Hand Control Panel.
- Connect terminals 4 to 7 of Solenoid Lock of Barrier A to respective Terminals of Pedestal A.
- Connect terminals 4 to 7 of Solenoid Lock of Barrier B to respective Terminals of Pedestal B.
- Connect Terminals 51 to 54 of Solenoid Lock of Barrier A/B to corresponding terminals in Control Panel for Boom Lock Indications. (Cable from Lock unit may first be brought into barrier pedestal & terminated at the spare terminals provided in pedestal.
- Terminals 51 to 54 may then be taken to panel, & terminals 55 to 58 to location box.)
- Provide 110 V AC Power Supply (5 amps) to Control Panel (Terminals M1 & M2).

3. CONNECTIONS FOR SIGNALLING/ INTERLOCKING:

- A break in the circuit for barrier closing has been provided at terminals 61 & 62 in Control Panel, so that suitable interlocking circuit can be introduced by Railways to ensure that barriers cannot be closed by pressing CLOSE button until required conditions are fulfilled.
- Similar break in the circuit for barrier opening has been provided at terminals 63 & 64 in Control Panel, so that suitable interlocking circuit can be introduced by Railways to ensure that barriers cannot be opened by pressing OPEN button until required conditions are met.
• In case no such interlocking circuit is provided, terminal 61 should be looped with terminal 62 and terminal 63 should be looped with terminal 64. If this is not done, circuit will not be complete & barriers will not work with push buttons on panel.
• The Boom Lock proving output Contact from boom lock relay of Barrier A has been wired up to terminals 65 & 66 in Panel.
• The Boom Lock proving output Contact from boom lock relay of Barrier B has been wired up to terminals 67 & 68 in Panel.
• The Contact of Emergency Bypass button has been wired up to terminals 69 & 70 in Panel.

(This contact should be used in series with the contact of LLS of lock unit A (terminals 55 & 56 in lock unit of barrier A) and LLS of lock unit B (terminals 55 & 56 in lock unit of barrier B.) to bypass the Magnet Switch Contacts in case of any malfunction of the latter.

Other output contacts for individual barrier positions (Open & Close), Crank Handle Switch, Boom Lock Proving switch etc. have been brought out to terminals in each pedestal. These may be suitable used by Railways for the Interlocking circuits.

4. Use of Magnet Switch Contacts in Railway Circuits:

• Two magnet switches, each having two contacts have been provided in the new solenoid lock unit. Contacts M1 & M2 are in one switch & M3 & M4 in second switch. These switches are operated by individual double magnets to ensure redundancy.
• Contacts of M1 & M3 in parallel have been wired up to terminals 51 & 52 in Boom Lock.
• Contacts of M2 & M4 in parallel have been wired up to terminals 57 & 58 in Boom Lock.
• The M1-M3 contacts are used in Control Panel circuit to operate respective relays in the panel, while M2-M4 contacts have been left as backup spare. (In case of any problems with contacts M1-M3, the spare contacts can be quickly wired into the circuits.)
• The output contacts of Boom Lock Relays (BLR) in panel have been brought out to terminals 65 to 68 in control panel. It is recommended that these contacts may be used in Railway Interlocking circuits.
• Alternately, the spare M2-M4 contacts can be used in the Railway interlock circuits. However, as the relay used in Railway circuits has a very high impedance, problems of fusing of magnet switch contacts due to high back
EMF has been noticed sometimes. This problem will be eliminated if the BLR contacts are used instead, besides saving M2-M4 for use as backup.

5. Use of Parallel Contact of Lock Limit Switch in Closing Circuit:

As may be seen in Circuit ELB-206-PDSTL -CRCT-06, a N-C Contact of Limit Switch in Lock unit has been introduced in parallel with the LS1 circuit in the barrier closing. (Terminals 6 & 7.)

Providing this contact makes adjustment of close position of the barrier very simple.

This contact ensures that motor stops only when boom tip actually falls into lock unit. (At present we try to control this from pedestal end which is difficult, and requires adjustment every time shape of boom changes even slightly.)

6. INSTALLATION OF BARRIERS

FOUNDATION

A small concrete foundation is required for mounting the barrier machine, as per detail given in barrier foundation drawing.(Doc. No. ELB-206-FD-01) A GI/ PVC pipe bend should be installed at the center of the 4 foundation bolts as shown for entry of power & control cables.

The dimensional accuracy of bolt centre/s is important to ensure exact fitting of barrier machine. (In case of slight mismatch at the time of fitting machine, fix a nut on the out of line bolt and hammer slightly in the required direction to take care of 2-3mm mismatch.)
FITTING MECHANISM

Lift mechanism box & place on foundation, such that the 4 nos. grouting bolts protrude through the 4 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 & towards the road. Ensure verticality of mechanism box (suitable packing may be provided below mechanism to achieve verticality if required), and tighten the 4 nos. nuts of the grouting bolts, along with washer & lock washer.
EQUIPMENT ASSEMBLY

Assembly should be carried out as per "Barrier Assembly". The counterbalance channels are already fitted when equipment is shipped from the factory, with channels in vertical position. Using Crank Handle bring the channels to horizontal position. Cranking should be done in direction of arrow showing "Close".

After bringing channels to horizontal position, 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 until balance weights are in place, otherwise the gear unit may get damaged.

The balance weights should then be fitted, and then 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 & closing.

NEW SOLENOID LOCK UNIT

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

Adjust position of Boom Lock Lever Type Limit switch as detailed in adjustment

CONTROL PANEL

Make suitable foundation for the Control panel.

Fix Unit Securely with the 4 foundation bolts so that it does not shake when Panel is operated.

7. INSTALLATION CHECKS & ADJUSTMENTS

BARRIER PEDESTAL & BOOM

- The pedestal, Boom & Balance weights should be fitted.
- Check that Pedestal is fitted properly (Water Level etc.) on the foundation, & fixing bolts fully tightened. Check that all the boom fixing bolts, boom joint bolts & Balance weight fixing bolts are tightened.
- Adjust the packing shims below the gear drive unit.
- Check that boom is properly balanced by adjusting the Balance weights.
- Check proper adjustment of friction Clutch.
- Check motor current during clutch slippage, and adjust clutch if required.
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, please remove or add packing shims below the gear box until almost optimum position is achieved. With barrier in closed position, this optimum position is when the gear box link & connecting link are in a straight line. Normally unit is dispatched with extra shims under gear box, so that adjustment can be done after installation.

Fig. 8: Connecting Link Feature

Fig. 9: Connecting Link Adjustment
BOOM BALANCING:

For this low power requirement hand generator type barriers, the boom should be carefully balanced, as the small motor provided cannot be overloaded for operating unbalanced boom.

After installation check operating current while opening & closing of barrier, and adjust balance weights until current is almost the same in both directions. However, balance should be slightly tilted towards the boom side so that in closed position the boom tips sits properly in the end post.

Fig.10: Boom Balancing

BOOM LOCKING ARRANGEMENT:

Check that the boom locking hook falls properly into the cutout provided in boom lock cum boom rest stand. Adjust lock unit position if required. (Slots have been provided on base of locking arrangement, as well as between Box & Base, so that adjustment in both directions can be made. Do not adjust adjusting nut on locking lever.

Check that the Magnet Switch contacts make (check with continuity meter) when boom hook is inside lock unit & lock lever is in locked position. Check that contact does not break even when boom is moved up & down or sideways within allowable play in lock. Check that contact breaks if lock lever is moved to unlocked position. In case of any problem with above checks readjust position of magnet switch/es or magnets.

Check angle of the Long lever type Limit Switch in Lock Unit (LLS) so that the switch just makes (Click sound is heard) when the boom hook is far enough inside lock unit so that lock lever can move to locked position.

Check that contact does not break even when boom is moved up & down or sideways within allowable play in lock. In case of any problem with above checks, adjust the angle of limit switch lever. Adjustment of angle is possible by loosening the Allen Bolt on the lever pin, and retighten after adjustment.
Firmly fix position of Limit switch lever after completing the adjustments.

**NOTE:** The solenoid lock works on 110 V AC supply (24 V in case of 24 V DC System).

As the solenoid 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.

### 7.1. CIRCUIT CONTROLLOR ADJUSTMENTS

- Adjust the position of the cams operating the limit switches.
- The Switches LS1 & LS2 have been specially provided for controlling the cut off point of motor in the closed & open position.
- Switch LS3 has been provided for controlling snubbing resistor & for giving feed to boom lock motor.
- Switches LS1 (N-O Contacts), LS2 (N-O Contacts), along with LS4 & LS5 (N-O Contacts) have been provided for feedback signals. These should be used in Rly. circuit as desired.

**Note:** While adjusting these switches, care should be taken that adjustment is not too critical. E.g. the close position switch should make at about 1-2 deg instead of 0 deg, so that adjustment does not become critical.

- Circuit controller adjustments have to be made after installation of barrier. Factory settings may not always work as angle of base/boom. Counterweights, boom curvature etc. may change after installation.
- The cams may also require adjustment after every accident with boom/repair of boom, as the camber of boom would change.
- Kindly ensure that all 3 fixing allen bolts on each cam are tightened after adjustment.

### MOTOR WIRING

The AC motor provided is a **new 3 wire AC Motor** (as compared to 4 wire motor used earlier) connected to terminals 1, 2, & 3 of pedestal/motorized lock. With this motor the control is greatly simplified as compared to the 4 wire motor used earlier.

Terminal 3 is common and to be supplied with 110 V AC neutral. If 110 V AC phase is given to terminal 1 the motor runs in one direction. If the 110 V AC phase is given to terminal 2, it runs in the opposite direction.

The supply is to be given either to terminal 1 **OR** to terminal 2 and not to both terminals simultaneously.

### BOOM LIGHT

The boom light is LED based & works on 24 V DC. It works only with proper polarity. It is to be wired by Rlys.
8. OPERATION OF BARRIERS

The operation of the barrier is as follows:

8.1. PUSH BUTTON ELECTRIC OPERATION

1) FOR OPENING:

Press OPEN push button, and keep it pressed. Barriers 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.

2) FOR CLOSING –

Press CLOSE push button, and keep it pressed. Barriers start closing and automatically stop in fully closed position. Keep the button pressed until both the barrier Locked indication Lights (Green) & both the Barrier closed indications lights (Amber) switch on.

3) FOR STOPPING IN THE MIDDLE

Stop Pushing the Button. Barriers stop in this position.

4) REVERSING

After Stopping as per above, press opposite button.(After waiting for 2 sec.)

8.2. EMERGENCY DIRECT CRANK OPERATION -

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, first open the internal flap inside the crank handle opening by using the special key provided. Then insert the barrier crank into the hole provided in the mechanism box rear door (opposite the road side) & thence into the shaft of the gear drive unit.

For closing rotate handle clockwise & for Opening rotate handle anticlockwise.

As soon as crank is inserted, electrical operation is automatically cut off, and remains cut off till crank handle is removed.

(For This operation, the 2 barriers have to be cranked individually from each barrier pedestal)

Note: Remember to use the key to move the internal flap back to cover the crank handle opening after manual operation is completed.
**EMERGENCY MANUAL UNLOCKING OF SOLENOID LOCK**

To unlock the boom lock manually, first open the internal flap inside the opening provided at the back of lock unit (on side opposite to door) by using the special key provided. (This is the same key as used for opening the flap of crank handle.)

Then insert the special square shaped key (with a dead weight on the other side of key) into the square bush of lock lever pin seen inside the lock box. This key should be so inserted that the dead weight at its end keeps the lock lever in unlocked position.

**Note:** Remember to remove the square key & move the internal flap back to cover the opening after manual operation is completed.

9. **MAINTENANCE**

The entire design concept of the equipment is that of a sealed system design with self lubricating units and materials. However some periodic maintenance checks are recommended as follows:

**FORTNIGHTLY MAINTENANCE**

- Check for smooth operation of Barrier.
- Clean the inside & outside of mechanism, lock unit, boom & channels, and Panel.
- Check for auto stop of Barrier in the fully open and closed position. Adjust limit switches if required.
- Check tightness of all fixing nuts and bolts of the mechanism base, gear box, motor, boom & counterbalance channels, bolts in motorized lock unit & the adjusting screws of the cams which operate the limit switches.
- Clean the inside of Solenoid locking device and ensure that the boom hook falls properly into the Boom Lock Post. Adjust position of Boom Hook/ lock unit if required.
- Check adjustment of Boom Lock Magnet Switches & Backup Limit Switch.

**QUATERLY MAINTENANCE**

- Check clutch slippage torque. Adjust if required.
- Check Timing Belt tension for both barriers. Adjust if required.
- Check contacts of limit switches. Replace switch if resistance is more than 1 ohm.
- Apply a little grease to the cam surfaces, which operate the limit switches.
ANNUAL MAINTENANCE

- Replace the oil in the barrier & Hand Generator gear unit.
- Use gear oil SAE- 90 or equivalent. Qty. 1.5 liters in each barrier & 0.3 Liters in each Hand generator gear box.
- Replace Timing Belts if worn out.
- Replace Clutch plate if required.
- Oil the clutch slippage bush.

10. PARTS REPLACEMENT

QUATERLY

Check positive Boom Lock Proving Limit Switches & Adjust/ Replace if required.

AFTER TWO YEARS

i) Replace Gear Oil- SAE 90, Qty. 1.5 Liter. 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.

ii) Replace Timing Belt. For Replacement simply slip off the belt from the Clutch Pulley Side. For fitting new belt, first put belt over the motor pulley, then slip over one side of the clutch pulley, followed by rotating the clutch pulley, till the belt falls into place.

iii) Replace Clutch Plate. For Replacement, remove split pin & Circlip provided on the clutch bush shaft. Remove the clutch bush & Clutch pulley. The clutch plate shall be found between the clutch coupling & the clutch pulley (behind the clutch pulley). Replace with new plate & put back the clutch pulley, clutch bush, circlip & split pin.

Fig.11: Gear Box Oil Change
11. ADJUSTMENTS

LIMIT SWITCHES IN PEDESTAL

Two limit switches LS1 & LS2 have been provided on the gear box shaft to control the auto stop in the fully open & closed position of the barriers, as also to provide back indications. (LS1 is next to the Gear Drive unit & LS2 is the one adjoining LS1).

Limit switches, LS3 (the one towards the bearing Block/ Machine side) has been provided on main boom shaft, to control the angle at which the snubbing resistor slows down the motor, as also to cut off supply to solenoid lock.

Two more Limit switches, LS4 & LS5 have been provided on main boom shaft after LS3, to give additional back indications in the fully closed positions.

The limit switches are actuated by contoured cams fixed on the boom shaft, and the position of these cams can be adjusted as follows:

- Loosen the cam fixing screws using an Allen Key.
- Adjust the position of the cam as required, by rotating it on the boom shaft.
- Tighten one of the cam fixing screws, and check the position of the cam by operating the barrier.
- Tighten all fixing screws after cam position is properly adjusted.

The Position of the cams are to be adjusted as follows:

- The cam for LS1 is to be adjusted such that its N-O Contact just makes in the fully closed position of barrier (approx. 0 Deg.).
- The Cam for LS2 is to be adjusted such that its N-O contact just makes in the fully open position of barrier (85-90 Deg).
- The cam for LS3 is to be adjusted such that its N-O contact just makes at about 20 – 30 deg to horizontal.
- The Cam for LS4 & LS5 are to be adjusted such that its N-O contact just makes in the fully closed position of barrier. (0 -2 Deg.).
FRICTION CLUTCH

The friction clutch is mounted on the input shaft of the gear drive unit in barrier pedestal, 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 the slippage torque. The slippage torque adjustment is done as follows:

- Completely loosen adjusting nut until clutch slips in barrier operation.
- Tighten the nut in 1 or 1/2 turn stages and check for boom 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 1/2 turn.

Fig.12: Limit Switch Adjustment

Fig.13: Limit Switch on Main Shaft
**Note:** In case clutch is observed to be slipping and the barrier is not moving, please check that there is no physical obstruction to boom or counterbalance channels, before tampering with clutch adjustment.

![Friction Clutch Adjustment](image1)

**Fig. 14: Friction Clutch Adjustment**

**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:

i. Loosen the 4 motor fixing bolts.
ii. Adjust the position of the motor, until desired belt tension is achieved, by providing suitable packing below motor/adjusting the motor.
iii. Re-tighten the 4 fixing bolts.

**Note:** As the timing belt does not transmit power by friction (unlike V Belts) it should be left a little loose & not tightened fully. A tight timing belt will break very soon.

![Timing Belt adjustment](image2)

**Fig. 15: Timing Belt adjustment**
BOOM LOCK UNIT MAGNET SWITCHES:

- After installation the working of the Magnet proximity switch should be checked by continuity meter to ensure proper functioning.
- Switch/es should make when boom hook is inside boom lock box & locking lever is in locked position. Contact should remain made even if boom if physically shifted around in the horizontal & / or vertical directions.
- Contact should break as soon as locking lever is moved to unlocked position by hand.
- The Magnets/switches position may be adjusted to achieve above function.
- After fitting & testing as above, please apply a little adhesive to the fixing nuts of switch and magnet to ensure that they do not get loose with vibrations.

BOOM LOCK UNIT BACK UP LIMIT SWITCH:

After installation, the working of the back up limit switch in lock unit should be checked.

Check angle of the Long lever type Limit Switch in Lock Unit (LLS) so that the switch just makes (Click sound is heard) when the boom hook is far enough inside lock unit so that lock lever can move to locked position.

Check that contact does not break even when boom is moved up & down or sideways within allowable play in lock.

In case of any problem with above checks, adjust the angle of limit switch lever. Adjustment of angle is possible by loosening the Allen Bolt on the lever pin, and retighten after adjustment.

Firmly fix position of Limit switch lever after completing the adjustments.

12. SPECIAL SWITCH FOR BOOM LOCK PROVING FOR ELECTRIC LIFTING BARRIERS

Special Magnet Proximity Switches have been provided to detect the closed & locked position of the boom. In the new lock unit the switches are with a robust Aluminum Die cast Body. Each switch has 2 contacts and two such switches have been provided.

FUNCTION

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.

CONSTRUCTION

A special non contact type magnetic proximity switch has been used for this boom lock proving. It consists of 2 parts i.e. the Switch Unit & the Magnet unit/s. The Al. Die Cast Body unit with 4 wires (in a spring sleeve) is the hermetically sealed dual reed switch, and is fixed to the boom locking lever inside boom lock.

The second part is the magnet actuator which is a thin rectangular unit in plastic body. This is fixed to the boom hook. Two magnets have been provided for each switch to provide redundancy & improve reliability. Also two such switch & Magnet arrangements have been provided for redundancy.

As soon as the magnet/s come within 0-50mm of the switch unit, the magnet actuates the reed switch and switch contact/s make. (This large actuation distance ensures that even if there is slight mismatch, or if someone shakes the boom after locking, the contact remains made.

INSTALLATION

The magnets & switches have already been pre installed and adjusted in factory. Operation should be checked after installation and adjustments in position of switch/magnets made only if necessary.

Suitable slots have also been provided in boom lock base plate & the boom stand base plate to adjust the position of the boom locking device in the direction of the boom & perpendicular to it. Do not try adjusting the angle of boom lock lever.

After installation the working of the proximity switch should be checked by continuity meter to ensure proper functioning.

Switch/es should make when boom hook is inside boom lock & locking lever is in locked position.

Contact should remain made even if boom if physically shifted around in the horizontal & / or vertical directions. Contact should break as soon as locking lever is moved to unlocked position by hand.

After fitting & testing as above, please apply a little adhesive to the fixing nuts of switch and magnet to ensure that they do not get loose with vibrations.
SPECIAL CARE

a) The switch is rated for 24 VA only. Please use it in relay circuit only.

b) Both portions of the switch have been installed on aluminum/ SS base plates, as fixing on magnetic steel surface will reduce its life & Efficacy.

c) In case 2 magnets are provided both poles (N-N or S-S) should be on same side i.e. magnets should repel each other when brought closer.

d) To avoid Switch burnout due to reverse EMF when contact breaks, Fix Diode in parallel across the Relay coil in appropriate direction, so that back EMF current passes thru this instead of the switch contact.

e) (Only In case magnet switch contact is used to directly operate High impedance railway relay.)

13. DO’S & DON’TS

DURING INSTALLATION

a) While joining 2 parts of the boom avoid use hammer, as boom may buckle due to column effect.

b) While installing the boom always install the boom first & then the balance weights.

c) Support the tip of boom while installing, until the balance weights are also installed, so that boom unbalance force does not damage the gear box.

d) Balance weights should be so adjusted that effort for raising & lowering is almost the same. However, balance should be slightly tilted towards the boom side so that in closed position the boom tips sits properly in the end post.

e) Limit switch / cam adjustment should be proper for auto stop of motors, boom lock detection & position feedback.

f) All 3 bolts of cams should be tightened.

g) Packing below gear box should be properly adjusted to ensure correct position of connecting link.

h) Before giving 24 V DC supply to boom light it should be ensured that there is no short in the wiring.

i) Nuts & bolts for joining boom sections should be properly tightened.

DURING OPERATION

j) Give a gap of at least 2 seconds while before reversing the direction of motion of boom by push buttons or by Crank Handle.

k) Close button should may be kept pressed for 1-2 seconds extra after barrier closed position yellow light comes on.

l) Crank handle for opening closing should be operated only in correct direction as per the arrow sign provided.

m) The manual crank handling normally requires very little force. If it requires extra force at any point, cranking should be immediately stopped and point of obstruction investigated.
DURING MAINTENANCE

n) While replacing the boom always install the boom first & then the balance weights.
o) Support the tip of boom while installing, until the balance weights are also installed, so that boom unbalance force does not damage the gear box.
p) Adjust limit switch cams properly so that adjustment is not too critical e.g. adjust at say 1 deg instead of 0 deg for barrier closed position.
q) Check contact resistance of all switches & contacts. Replace switch/contacts if contact resistance is high.
r) Keep all operating parts clean. Keep all fixing bolts properly tightened.
s) Seal nuts with an adhesive where possible to avoid loosening due to vibrations.
t) Do not adjust timing belt tension like a conventional V Belt (which works under tension). If timing belt works under tension it will break very soon.
u) Check Timing belt every 6-12 months & replace if required. Replace in any case after 2 years (as it is a rubber part).
v) Replace gear oil annually or at least after 2 years.
w) Replace friction clutch plate annually or at least after 2 years

14. USE OF EMERGENCY BY PASS BUTTON ON PANEL & BACK UP DETECTION LIMIT SWITCH PROVIDED IN LOCK UNIT

Under normal working conditions, the magnet proximity switch (MS) proves the closed & locked position of the barrier. Two such switches, each having 2 contacts have been provided in each lock unit, MS1 & MS2 in one switch, and MS3 & MS4 in second switch, to give total 4 contacts for redundancy.

The magnet switch contacts MS1 & MS3 in parallel are used to pick up a relay (BLR) in the panel. (Contact MS2 & MS4 have been left as spare backup in lock unit. If desired these spare contacts can also be used by Railways.) When BLR picks up it operates a green light “Barrier Locked” indication on the panel.

A mechanical Limit Switch LLS has also been provided in the lock unit. This limit switch (having 2 N-O + 2 N-C contacts) is suitably adjusted such that its N-O contact makes only when boom lock hook at the tip of the boom has gone far enough inside the lock unit to enable locking lever in lock unit to move to locked position. When this switch operates, it switches on an amber indication light ” Boom closed” on the panel.

Under normal working, when booms are in closed position the two green lights & two amber lights (for both barriers A & B) are seen on the panel, and contacts become available for clearing train signals.

However, in case operator finds that one of the green lights does not light up when barriers are closed, but the amber light of the barrier comes on, he knows that barrier has actually closed.
He can then go out and physically check that barrier is locked by trying to lift the boom & if required he can also use the manual key to physically move locking lever to locked position

He should then be able to bypass the Magnet switch contact by using the Emergency Button provided on panel. Railway can provide a suitable circuit for this bypass using the contact of Emergency button & the N-O contact of LLS.

**Note:** Bypass should be possible only if LLS contact is available.

One possible circuit is shown below, but Railways should verify suitability from operation/ safety/ suitability etc.

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*Fig 16: One of the Possible circuits for use of backup limit switch contacts in lock & emergency bypass button on panel*
B) 24 V/110 V DC ELECTRICALLY OPERATED LIFTING BARRIERS WITH MOTORIZED LOCKING (with hand generator). (M/s HEIDZ make)

As per Speciation no. RDSO/SPN /208/2012.

Main differences in 24 V/110 V DC Electrically Operated Lifting Barriers with Motorized Locking (with hand generator) as compared with 110 V AC Electrically Operated Lifting Barriers with Solenoid Locking (without hand generator) are as follows.

1. **BREIF DESCRIPTION OF THE SYSTEM:**

   **MOTORIZED BOOM LOCKING ARRANGEMENT**

   One such unit is provided for the tip of the boom for each pedestal.

   This arrangement locks the tip of the boom in the fully closed position, and also provides a positive boom lock proving contact. Locking & unlocking is by motor which moves the lock slide by rack & pinion arrangement. 3 limit switches are also provided in the unit to control sequence of operation.

2. **HAND GENERATOR CUM CONTROL PANEL**

   This unit is provided in the Gate Lodge/ Cabin.

   This unit incorporates the necessary switches & buttons to operate the barrier when the Input DC Power Supply is available.

   It also incorporates the hand Generator unit with a suitable winch. In case of Input Power failure, rotating this winch manually, generates Electrical power which is used to again operate the 2 booms electrically.

   In case of cable/ generator failure, arrangement for direct mechanical hand cranking is also available individually at the 2 pedestals.

   ![Hand Generator cum Control Panel](image-url)
3. **POWER SUPPLY REQUIREMENTS**

24 V DC Power Supply Minimum 15 amps (or 110 V DC supply minimum 5 Amps for the 110 V DC System) up to Hand Generator cum Panel Unit.

4. **CABLING REQUIREMENTS**

   Electrical cabling & connections have been totally simplified, and minimal cabling is required, as follows:

   - A minimum 9 core cable between Hand Generator Cum Panel Unit & each pedestal, for the barrier operation (Additional Cores required for Signaling circuits.)
   - A minimum 12 core cable between each Motorized lock unit & respective barrier pedestal.
   - Cabling as required for Signaling circuits, interlocking etc. as per Rly. Circuit. Approx. 20 – 25 cores from each pedestal to Relay Rack,
   - A 10-12 core cable between Hand Generator Cum Panel Unit & Relay Rack.

5. **ELECTRICAL CONNECTIONS**

   Connections to be made for operating the barrier:

   - Connect Terminals 1 to 3, along with 8 & 9, of Barrier A to respective terminals A1 to A3 & A8 & A9 provided in Hand Generator Cum Panel.
   - Connect Terminals 1 to 3, along with 8 & 9, of Barrier B to respective terminals B1 to B3 & B8 & B9 provided in Hand Generator Cum Panel.
   - Connect terminals 3, 4, 6 & 7 of Motorized Lock of Barrier A to respective Terminals of Pedestal A.
• Connect terminals 3, 4, 6 & 7 of Motorized Lock of Barrier B to respective Terminals of Pedestal B.
• Connect Terminals 51 to 54 of Motorized Lock of Barrier A/ B to corresponding terminals in Hand Generator for Boom Lock Indication/s. (Cable from Lock unit may first be brought into barrier pedestal & terminated at the spare terminals provided in pedestal. Terminals 51 to 54 may then be taken to panel, & terminals 55 & 56 to location box.)
• Provide 24 V DC Power Supply (15 amps) to Hand Generator Unit (Terminals M1 & M2). (110 V DC 5 amps for the 110 V DC System.)

6. INTERLOCKING IN HAND GENERATOR TYPE BARRIERS –

While the interlocking contacts provided at terminals 61-62 & 63-64 will be effective to control required barrier interlocking in the Push Button mode of barrier, this interlocking gets bypassed when barrier is switched to Hand Generator mode.

To ensure interlocking in the hand Generator Mode, the supply going from Hand Generator to Barrier pedestal (cable terminals 1, 2 & 3) itself need to be interlocked by a signaling relay. Hence when this relay operates to clear the train signals, complete supply to barrier pedestal should be cut by contacts of this relay. This will ensure that even if Hand Generator is cranked barrier/s will not open.

Preferably, this relay should be fixed in the hand Generator unit itself, so that cable length between Hand Generator & Pedestal is minimized, to reduce voltage drop (which is a potential problem for 24 V DC Barriers.)

7. INSTALLATION OF HAND GENERATOR CUM PANEL:

Make suitable foundation for the Hand Generator cum panel. A GI/ PVC pipe bend should be installed at the center of the 4 foundation bolts for entry of power & control cables.

Fix Unit Securely with the 4 foundation bolts so that it does not shake when barrier is operated by hand Generator Winch.

BOOM LOCKING ARRANGMENT

a) Check that the boom locking hook falls properly into the cutout provided in boom motorized lock cum boom rest stand.
b) Adjust lock unit position if required. (Slots have been provided on base of locking arrangement, as well as between Box & Base, so that adjustment in both directions can be made.
c) Adjust angle of the Long lever type Limit Switch in Lock Unit (LS6) so that it detects that boom hook falls into Locking unit & locking motor moves lock slide to locked position.
d) Adjustment of angle is possible by loosening the Allen Bolt on the lever pin, and retighten after adjustment

e) Firmly fix position of switch after completing the adjustments.

NOTE

a. The motorized lock works on 24 V DC supply. 110 V DC in case of 110 V DC System.

b. As the unit needs to be energized only at the start of opening/ closing, the feed is given through the N-O contact of switch LS3, as per Pedestal circuit.

c. **Also as** may be seen in this Circuit, an N-C Contact of Limit Switch LS6 in Lock unit has been introduced in parallel with the LS1 circuit in the barrier closing (terminals 6 & 7.)

d. Providing this contact makes adjustment of close position of the barrier very simple.

e. This contact ensures that motor stops only when boom tip actually falls into lock unit. (At present we try to control this from pedestal end which is difficult, and requires adjustment every time shape of boom changes even slightly.)

**MOTOR WIRING**

The motor provided is a permanent Magnet DC Motor (PMDC Motor), having only one winding with 2 wires, connected to terminals 30 & 10 in barrier pedestal.

By giving 24 V DC Positive to terminal 30 and negative to terminal 10, 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 & 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 & the other while closing.

**BOOM LIGHT**

The boom light is LED based & works on 24 V DC. It works only with proper polarity. It is to be wired by Rlys.

**POLARITY REVERSAL**

If for any reason barrier/ lock motor is rotating in wrong direction, interchange motor terminals.

If Diodes are not working as per detailed above (eg. if boom lock is operating while closing & 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.

8. **EMERGENCY MANUAL OPERATION OF MOTORIZED LOCK**

To operate the boom lock manually, first open the internal flap inside the opening provided at the side of lock unit (on side opposite to where boom hook falls into lock) by using the special key provided. (This is the same key as used for opening the flap of crank handle.)

Then insert the special key with a threaded end and screw the threads onto the nut at the tip of the lock slide.

The lock can now be operated manually by pushing & pulling the key for locking/unlocking.

9. **PERIODIC MAINTENANCE & PARTS REPLACEMENT**

The entire design concept of the equipment is that of a sealed system design with self lubricating units and materials. However some periodic maintenance checks are recommended as follows:

**FORTNIGHTLY MAINTENANCE**

- Check tightness of all fixing nuts and bolts of the mechanism base, gear box, motor, boom & counterbalance channels, bolts in motorized lock unit & the adjusting screws of the cams which operate the limit switches.
- Clean the inside of Motorized locking device and ensure that the boom hook falls properly into the Boom Lock Post. Adjust position of Boom Hook/lock unit if required.

**QUATERLY MAINTENANCE**

- Apply a thin film of grease to the rack & pinion Gear in Motorized lock unit.

**SNUBBING RESISTOR SETTING**

- Depending on the input voltage available at the pedestal, the value of the variable snubbing resistor needs to be adjusted, to achieve a smooth stop in the closed position.
- With input voltage of 23-24 V DC, the snubbing resistor may be set at about 4-6 Ohms.
- For Lower Voltage setting should be lower, while for higher voltages, ohm value setting should be higher.
- Care should be taken that the resistance value set is not so high that the motor fails to operate with any slight drop in input voltage.
SECTION-IV

1. **EMERGENCY SLIDING BOOM:**

Emergency Sliding Boom is provided in addition to Electric Lifting Barrier at Level Crossing gates for passage of trains on proper signal when Electric lifting barrier is defective or damaged due to hitting of any road vehicle or failed due to any other reason and barriers can not be closed properly.

1.1. **Operation of Sliding Boom:**

Two Emergency Sliding Booms are installed on either side of the track. Emergency Sliding Booms are operated and locked by means of man power to close and lock the LC gate for passage of trains on proper signal when Electric lifting barrier is defective due to any reason and gate can not be closed and locked against road traffic.

Emergency Sliding Booms are operated and locked as per the following.

First one sliding boom situated at far end of the LC Gate hut is operated first by man power and forward end of the boom is inserted in the hole provided on the locking post fitted on the other side of the road.

Key of ‘E’ type lock (painted in yellow colour) attached to the boom with iron chain is inserted in the lock fitted on the locking post and turned. This lock is unlocked and make the other ‘E’ type lock key (painted in red colour) free for turning and locking the boom in locking post.

Now this boom installed at far end of LC Gate hut is locked by turning this key (painted in red colour) in the locking post fitted at other end of the road.

Now Key (painted in red colour) is released from this locking post grounded at Far end of the LC Gate hut and this key is inserted in the other locking post grounded at near end of the LC Gate hut and turned to unlock the lock fitted on the locking post.

Now 2nd Sliding Boom is operated by man power and key(painted in yellow colour) attached with the boom with iron chain is inserted in the 'E' type lock fitted on the 2nd locking post at near end of the LC Gate hut and turned to unlock the lock.

Space is available to insert the forward end of the boom in the hole of the locking post. Now forward portion of the boom is inserted in the hole provided on locking post.

Now 3rd key (painted in green colour) can be operated to lock the boom in the locking post and released after locking the boom in the locking post.
Signal can be given by this 3rd key (painted in green colour) for passage of trains on signal or in case of level crossing gate is interlocked with the station, slot for giving signal can be given to ASM with the help of this key.

**Fig. 1: Emergency Sliding Boom**

**Fig. 2: Locking Post at far end of LC gate hut**

**Fig. 3: Locking Post at near end of LC gate hut**