CHAPTER 1

INTRODUCTION

When road traffic crosses the rail traffic at the same level they are known as l-xing (level crossing) & the gates that are provided to protect rail traffic against road traffic are known as l-xing gates. The locking arrangements provided on gates for their protection are known as level crossing gate locks. In l-xings the roadway is brought into the level of rail tables & guard rails provided to contain the roadway clear of wheel flanges.

The general classification of l-xing gates is settled by engineering department in consultation with the local govt. & administration concerned, based on a joint consideration of the nature of road, the number of road vehicles & the number of trains passing over the crossing. The gates are:

i) Special,
ii) 'a' class,
iii) 'b' class, \( \Rightarrow \) for road crossings
iv) 'c' class,
v) 'd' class \( \Rightarrow \) for cattle crossings.

1.1 LIFTING BARRIER GATE

Lifting Barrier gate is an important safety device, installed on both sides of the Railway track in parallel at level crossings. It warns the road traffic by its bell gong and checks the movement of the traffic at the time of train passing through track. It prevents accidents between train and road vehicles.

Lifting barrier gates are operated either manually or electrically. Manual lifting barriers are operated either through winch or force dropping.

This handbook covers maintenance and installation on winch operated manual lifting barrier gates.

1.2 WINCH OPERATED GATE

At the road side according to the requirement and breadth of the road different types of L.B. Gates are installed. These gates are operated with the help of a winch and are having locking arrangements. These gates are installed in pairs and both booms are closed or opened simultaneously.

In the winch operate gates, the Gateman need not walk up to the gate. He has to just handle the Winch of the LB gate, which is installed near his cabin. At the same time and from the same place he locks the gate. Following locking arrangements are provided in the gates.

i) Locking is established in between trunnion roller and lock drum.
ii) Boom is locked with the help of boom lock fitted over the stop post which is operated by rodding connected with lever.
iii) Winch is locked with "E" type lock fitted on the winch with the help of drum and handle locking lever which also locks the “locking wheel”.

CHAPTER 2
MAIN PARTS AND WORKING

2.1 MAIN PARTS

Main parts of Lifting Barrier are as follows:

2.1.1 Winch.

An operating unit which consists of driving wheels (winch) & releasing lever, located in the cabin or ground frame. The various parts of winch are shown in figure.

Fig No. 1
2.1.2 Pedestal with Fittings

It is a fabricated structure made with MS angle (75x75x10) mm and (125x75x10) mm It provides a proper base to the LB gate components. All main assemblies such as main axle bearing, boom pipe fitted with main axle, warning bell, gate indicator lamp and lock drums are mounted over it with appropriate fasteners. The pedestal is fixed and tightened with eye bolt over cement concrete foundation. This foundation should be strong enough, so as to bear the load of the complete LB gate. Important parts of the pedestal fittings are shown below:

LIFTING BARRIER - RH (FOR LEVEL CROSSING)
SA7981-88

1. Gate indicator
2. Bell
3. Guy arm
4. Clamp A
5. Trunion bracket
6. Auxiliary weight
7. Balance weight
8. Drum
9. Bracket
10. Pedestal
11. Fringes
12. Stop post
13. Tabular pole
14. Indicator disc
2.1.3 Locking Unit

This ensures that the gate booms can not be opened, once the gate signal is taken off for a train. A lever, when operated actuates a plunger in both the booms, thereby locking the gate booms in the reverse position of the boom lock lever only. The signal lever gets released in the ground frame or cabin. The important parts of Stop post with boom locking arrangement are shown below.

![Stop post with boom locking arrangement](image)

2.2 Working

- The barrier drum is connected by double wire transmission with the gear on the winch.

- The gear axle operates another set of pinions ‘a’ & ‘b’ on the other side of the post which is employed to actuate a locking wheel to achieve winch locking by means of an `E’ type lock, to ensure that key can be extracted only in closed position.

- The winch is located close to the gate or installed in the cabin, if the cabin is located close to the level crossing gate. The range of winch operation of lifting barrier from the point of operation is 150m. After the barrier is closed key can be extracted from the 'E' type lock on the winch.

- This key is taken out to release the gate lever which when operated release the gate signal.

- Gate lever is used for locking of the poles of the barrier by means of a lock. In addition, a detector is provided to prove the barrier is in closed position before the gate signal taken off.
It is preferable to use hook locking by having the transmission partly as a rod run & partly as a wire run when winch operated lifting barrier is situated at a distance of 150m from the cabin.

With the barrier at open position, the roller fitted on drum rests against the outer surface of the trunnion bracket. The barrier is thus held by the roller fitted on the drum & by the stop on the trunnion bracket being engaged against the rim on the drum.

When the drum is operated through the winch a warning bell starts ringing & the operating roller fitted on the drum enters the trunion bracket roller path & drives the barrier pole & on further rotation of the drum the barrier is brought to the closed position.

The stop on the drum is engaged with the stop on the trunnion bracket holding the barrier in the closed position.

The warning bell is provided just above each pedestal. The hammer of the bell is connected to a crank which is operated by the projections provided on the periphery of the drum. The projections impart stroke to the bell when the gate being closed. The bell is made to ring when barrier is being closed & does not ring when the barrier is being opened.

An indicator lamp is also installed above each pedestal & shows red & white light when barrier is closed and open to road traffic, respectively.

The present day systems use partly wire run (for operating the boom) & the partly rod run for locking the boom. The gate locking is accomplished by using ‘E’ type locks & transferring the keys either electrically or mechanically. The key released from the winch is transferred to ground frame for locking the boom.

When the gate is in locked position the 'E' type key of winch lock is released. The released key is inserted in boom lock lever. When the lock lever is reversed, another key is released from boom lock lever, which can be inserted in EKT or midway lock and transferred electrically or mechanically to signal lever.

Electrical key transmitter is used to transmit the key electrically to avoid delay in physical transmission. It is provided with a Galvanoscope to give an indication that the key has been transmitted. It is to be locked & sealed for security reason. The electromagnet of EKT has a coil resistance of 13 ohms & minimum voltage required is 10 v dc & working voltage is 12 v dc & current is 350 ma. For bell circuit, 4 v to 6v dc is required. It has 5 contact springs.

Gate locking in conjunction with approach locking is achieved electrically using track circuit as is done in auto signalling section & PL/RRI stations.
CHAPTER 3
INSTALLATION

To obtain proper service with gate, it should be installed secured over a rigid foundation.

3.1 Pedestal
It should be installed over a cement concrete foundation with prefixed foundation eyebolt. A pedestal supports the shaft bearings and driving equipment.

3.2 Boom pipe
The boom pipe should be fastened according to the arrangement.

3.3 Gate warning Bell
It is fastened over the pedestal on that side where lock drum is fixed. If the boom is of left hand side then the bell is fixed at left side. On the pedestal for fastening the bell, holes are provided. The pawl of the bell should be adjusted properly with the teeth of the lock drum. Proper gap should be maintained in between pawl and lock drum body for its free movement.

“Mechanical bell is not so effective therefore an electronic hooter is desirable”

3.4 Gate Indicator lamp
The bracket of the lamp is fastened over the arm of the pedestal with hex nut and bolts size 12x15 mm. The lamp plug is riveted in the lower end of the moving pipe along with bend flat. This bend flat provides support for free movement to the inner pipe. If the boom is of right hand side then lamp assembly is fastened on the left side. The cam roller and the crank are then joined. Finally cam is adjusted and tightened with bolt size 10 x 15mm.

NOTE:-“Provide electrical/LED flashers where power supply is available”.

3.5 Winch
The winch is installed over a rigid concrete foundation and fastened with foundation bolts. The E type lock is screwed over the lock frame. Tie one end of the rope wire with special pin with the hundred-teeth gear and wind the required length of wire over the slot provided in it. The rope wire runs in between the gate and winch as shown in figure 4. After closing the gate, the locking wheel notch and the plunger of ‘E’ type lock are adjusted so that while locking the winch, the plunger is housed in the notch of the locking wheel.
3.6 Guy Rod

Clamp the guy arm flat over the trunnion and the larger arm hooked in the front of the boom pipe. The shorter arm is tightened with the lug welded in the rear portion of tubular pipe. The tension is adjusted with the help of couplings provided in the longer and shorter arms.

3.7 Precautions in RE Area

- Both pedestal units should be earthed in RE section and its value should not be more than 10 ohms.
- Proper insulation should be provided in wire run and rodding in RE area.

After installation ensure that all moving parts are properly lubricated.

CHAPTER 4
MAINTENANCE

4.1 Routine Maintenance

For trouble-free working of mechanical lifting barrier, following procedure may be followed:

The maintenance intervals may be modified to suit local conditions at the discretion of DSTE/ Sr. DSTE. It includes both mechanical/ electrical Gates & also electrical equipment in case of mechanical gates.

The maintainer Should ensure that he is has all the tools (see chapter no.5) and consumables like cotton waste, oil, grease and wires, etc required for maintenance. Maintenance is to be carried out part-wise given below

4.1.1 Boom

⇒ Operate the gate and see that both the booms are moving simultaneously.
⇒ If the operation is hard then check for any obstruction in the entire wire transmission, i.e. winch to function, remove the same.
⇒ Check booms are moving simultaneously or not if not then adjust stay guide and balance weight of the boom by trial and error method and correct alignments pull and return wire near drums of both boom.
⇒ See that booms are resting properly on its boom stop when closed, if not then correct the alignment.
⇒ See that there is no crack on the boom. Crack if any may be temporarily put right by providing the iron strip/angle as shown below and such booms must be replaced on priority.

![Diagram of Jointing nut bolts, Crack observed, Iron strip/angle, boom]

**Fig No. 4**

⇒ Repair the boom fringes, if broken.
⇒ Check the Stop board of the boom on either side and ensure that red reflectors are properly fixed.
⇒ Ensure the free roller movement in the cam path during boom operation. Cam path should be free from dust and oil mud. It should be cleaned and oiled. The gap between roller on the drum & campath should be minimum.
⇒ Check that Gate indicator is properly fixed, if not then adjust it and verify its visibility from a distance of 100 m.
⇒ Check that all three pieces of the booms are in perfect straight alignment. Cross bolts at both the joints are fully tight.
⇒ Ensure tightness of balance, Auxiliary weight and cylindrical weight in place. There should not be a slightest displacement possible during the course of opening and closing of the gates.

**Procedure for Positive Boom lock check**

⇒ Close the gate and try to reverse the gate lever by lifting one boom. It shall not operate. Test the second boom similarly.
⇒ In the closed condition of the gate, gate lever can becomes reverse. Try to lift the booms one after another it should not lift.
⇒ Ensure that minimum movement of lock plunger is not less than 100 mm (4") inside the notch.
⇒ Try to lift the boom in closed and unlocked position, it should not be possible to lift the boom more than 225 mm (9") at the free end.
4.1.2 Pedestal unit

⇒ Tighten the pedestal nut bolts of the foundation, if they are loose.
⇒ Check and tighten the trunnion bracket, guy arm nut bolts properly.
⇒ Check the gate bell and whether its functioning is proper or not i.e. 16 beats of pre-warning, ringing during closing operation of the gate and no sound while opening operation of the gate. Clean the associated wheel teeth and lubricate the same by graphite.
⇒ For loudness of the warning bell beats, the bell gong must be kept fully tight in its seat and stroke of hammer strikers should be touch and go type, meticulous adjustment of spacing with inner face of the gong.
⇒ Ensure timely replacement of bell actuating parts, which are worn-out and cause loss of stroke.
⇒ Clean the pedestal drum and its teeth; it should be free from dust since dust is accommodating on it frequently due to rail and road traffic. Lubricate the drum after removing the dust.
⇒ Ensure that not a single tooth is broken on the drum. Also check minutely for crack developed on the teeth.
⇒ Ensure that roller on the drum is free to rotate and lubricated, free from muck but its bolts is not getting worked out from thread- worn in the drum.
⇒ Ensure that the wire rope roped around the rope drums and winch gear have sufficient turns for full opening and closing of lifting barrier.
⇒ Check whether any diversion wheel is not excessively worn-out and nor wobbling. Also ensure that no foundation is shaky.
⇒ Ensure that periphery of not a single diversion wheel is broken and all wheel guides are located at right places and are fully tightened.
⇒ Ensure that there is no excessive sag developed in ropes due to any jamming in pipes or on diversion wheels or due to mal adjustment of length.
⇒ Ensure that wire rope is not overlapping at the winch and rope drums and there is no tendency of working out from rope ways.
⇒ Ensure that guy rods are having sufficient tension for smooth operation and booms are perfectly straight without a bulge or sag.
⇒ Check the adjustment of gate lamp, warning bell/buzzer and flasher light, adjust if required specially the light aspects of lamp should be adjusted for skew and curved approach roads from a sufficient distance.

4.1.3 Winch and Wire run

⇒ Remove oily mud/waste with kerosene.
⇒ Provide lubrication by applying grease on gear of train, i.e. teeth of the gears.
⇒ Check whether locking key is possible to extract from the winch in gate open condition. It should not be possible.
⇒ Check if winch drum is locked in close condition and if it is possible to operate the winch when key is extracted. It should not be possible. Even the handle of the winch also should be locked with locking plunger.

⇒ All gate locking apparatus must be examined regularly & working parts oiled. Gate locks must be kept in working order.

⇒ Heavy repairs, renewals or alterations to gate interlocking must not be carried out until the Inspector concerned has arranged for protection of the traffic.

⇒ Check whether brass bushings of heavy gears have developed excessive wear and needs replacement.

⇒ Arrest excessive side play of locking plunger and its lower handle on winch body by adding washers packing.

⇒ The wire run within duct should have no obstruction.

⇒ Check all wheel guides for correct alignment. Wheel guide should be free from dust. Provide lubrication oil in guide wheel.

⇒ Wire run within duct should be cleaned every month positively and parallel wire should be provided.

⇒ Check that transmission wires are free from kink and twist.

⇒ Check that wire diverting pulley and guide are free from dust.

⇒ Check ‘E’ types keys & EKT are maintained properly.

⇒ The gate lever should operate uniformly.

⇒ Transmission of keys should be as per sequence.

⇒ Track circuits flashing light, warning bells & connecting cables should be tested & maintained so that approach indications (audible/visible) never fail.

⇒ Electric lever lock and ‘E’ type locks on winch and gate lever and EKT must always be kept sealed by maintainer.

Note: For trouble free system, graphite should be provided on all lubrication parts, i.e. moving parts.
4.1.4 Overhauling of Lifting barrier

- All moving parts subjected to regular wear and tear should first be replaced with similar new/overhauled parts once in two years.
- Parts thus replaced should be sent to Division workshop for overhauling.

4.2 Inspection of Interlocked L.C. Gates by supervisor and Officer

In general

- The approach road should be in level.
- The gate equipment should be provided as prescribed in the working rules.
- 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 the level crossing gate are in the 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 the 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 the gate.
- Ensure that the boom locking is effective.
- Ensure that all S&T gears are in working order.

4.3 Trouble shooting

4.3.1 Breakage of transmission wires

<table>
<thead>
<tr>
<th>SR.NO.</th>
<th>CAUSE</th>
<th>REMEADY</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>At the pipe and ducts.</td>
<td>Replace the wire. Use parallel wires inside pipes and ducts.</td>
</tr>
<tr>
<td>b)</td>
<td>At the thimbles, insulation ball joints</td>
<td>Make the joint properly and solder it.</td>
</tr>
<tr>
<td>c)</td>
<td>At the driving wheel</td>
<td>Replace the wire and adjust the alignment or replace the wheel if worn-out.</td>
</tr>
</tbody>
</table>
4.3.2 Wire out from wheel or winch

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>CAUSE</th>
<th>REMEADY</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Wire tight at wheels</td>
<td>Check for excessive wear of wheels and adjust it.</td>
</tr>
<tr>
<td>b)</td>
<td>Wire out from winch</td>
<td>i) Replace the wire if not soft and provide new lubricated rope wire.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Check winch gear wheel, replace if worn-out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) There should not be jamming in the wire run, adjust it.</td>
</tr>
</tbody>
</table>

4.3.3 Roller out from campath

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>CAUSE</th>
<th>REMEADY</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Drum bracket loose</td>
<td>i) Fully tighten drum bracket with through bolts of 20mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Use suitable no. of washer to left side of drum bracket so that drum periphery will be very close to the truniun bracket face which will prevent the possibility of roller out from campath.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) Replace center pin of drum if bent or worn-out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv) Replace roller and its bolt if excessive play developed.</td>
</tr>
</tbody>
</table>

4.4 Do’s and Don’ts

4.4.1 Do’s

- Ensure protection of traffic, then start heavy repair works, renewals & alterations on proper disconnection memo permitted by competent authority like cabinman, CASM/SM on duty.
- Ensure that in all cases the signal can be taken ‘off’ for rail traffic only after the gate is closed & locked against road traffic.
Ensure that all components of the gate are functioning properly, only then reconnect them.

Ensure proper sealing of EKT’s & interlocking with other locks.

Ensure cleanliness in the cabin, ducts for wire run & pits for pedestals.

Replace the wire at ducts/ GI pipes after every six month to avoid breakage of wire due to corrosion/ water logging.

Mechanical rotating parts should be cleaned & oiled regularly.

Ensure proper functioning of all electrical equipments in mechanical/electrical. Gates, cables, indicators (audible/ visible) & power supply system.

All necessary instructions relating to maintenance/ testing/overhauling that varies from time to time should be properly followed.

### 4.4.2 DON’TS

- Use improper grade of oil for lubrication. Black mineral oil/graphite should be used at respective places.
- Use harder type wire rope on winch drum
- Allow wire/rod run to rub against ballast, base of rails & ducts, etc.
- Allow damage items/wire/rod/pulley, etc. to remain in transmission.

- Forget to take safety precautions while working of l-xing gate.
- Forget to test interlocking with proper sequence after installation.
- Allow the boom to operate erratically.
- Start work without obtaining proper permission on Disconnection Memo.
- Forget to get seal the items required to be sealed such as EKT, etc.
- Allow excessive gap between drum roller and trunium bracket face.
CHAPTER 5
TOOLS

Tools are required for the maintenance and trouble free working. A list of the recommended tools is given below:

- Hammer 1 no.
- Chisel 1 no.
- Spanner set 1 no.
- Adjustable spanner (12”) 1 no.
- Adjustable spanner (15”) 1 no.
- Tommy bar 1 no.
- Disconnection memo book 1 no.
- Tablet seal & wire 1 no.
- Crow bar 1 no.
- Green and red flag 1 no.
- Punch, 5/8” 1 no.
- Tin smith’s tool kit 1 no.

CHAPTER 6
SUGGESTIONS AND IMPROVEMENTS

6.1 Provision of dummy booms at LC gates

The cases of LC gates damage have increased considerably, due to phenomenal increase in the road traffic and the rush driving. Damage to interlocked lifting barrier results into heavy interruption to the train traffic. Provision of the dummy booms at the railway crossing is the solution. The dummy booms are closed and opened before and after closing and opening of the interlocked boom respectively. A typical figure is shown below.

Fig No. 5
The salient features of the arrangements are as under:

6.1.1 Provision of the dummy booms should be confirmed to RDSO drg. No. RDSO/S-3453.

6.1.2 Dummy booms which are 11.7 meters long made of three sections of GI pipes of successive reducing diameters of 5", 3" and 2".

6.1.3 In order to make the operations of the dummy booms smoother, ball bearings of size 1¾" have to be provided in the fabricated pillow blocks mounted on the pedestals of both the dummy booms. The main shaft rotates inside the ball bearing thus reducing the friction considerably.

6.1.4 Dummy and main booms move in unison while opening and closing of the gate, through a “J” shaped coupling made of 1½" MS flat, fixed at a distance of about 50 cm from the extremities of both dummy and main booms.

6.1.5 One end of the MS flat is fixed rigidly by means of a through bolt on the main boom and the other end is bent in “J” shape.

6.1.6 The “J” arm is painted red and white to make a conspicuous so that pedestrian is warned of the lowering booms.

6.1.7 The long and small arm of the “J” are about 2500 mm and 40 mm long respectively in closed position, the long arm of the “J” clamp is passing below the dummy boom i.e. the dummy boom is resting on the long arm. With this arrangement the dummy boom alone can not be lowered of its own. By any external force such as storm and miscreants.

6.1.8 Owning to the shape of “J” clamp, the dummy boom is free to move only forwards the main boom is the direction in which it will tend to move or bend by when hit be a rod vehicle.

6.1.9 When a road vehicle hits the dummy booms while opening/ closing or in closed position, it will get uncoupled after bending / moving by about 40mm towards the main boom and fly back to open position. This can be achieved by meticulous balancing.

6.1.10 In order to safe guard the pedestal, shafts and ball bearings etc. from impact of road vehicle, mechanical fuses have been provided at every joint of the GI pipe and the first fuse has been provided near the shaft.

6.1.11 Four cast iron flats have been proved at every joint of GI pipes as mechanical fuse which are strong enough to withstand normal load of the boom but weak enough to give a on an accidental dash by a road vehicle. The ends of the pipes have been butted against each other instead of pushing the ends of smaller pipes into the bigger once.

6.1.12 Mechanical pre-warning bells of 16 beats are maintained while closing of the LC gate. In addition to this an audio-visual pre-warning by means of a 40 watts hooter and CLS (colour light signal) road signals may be given.
6.1.13 Additional supports for dummy booms in closed position, similar to the boom rest posts have to be provided near the shaft end. Such supports do not permit the impact of vehicle dash on to the shaft, ball bearings, pedestal etc.

6.1.14 Since all the four booms rise/fall simultaneously, chances of confusion to the road users due to contradictory indication of one open and one closed boom are avoided.

As per RDSO letter no. STS/MM/LBG dated 3.6.96, a similar arrangement is working successfully in Ratlam division of Western Railway.

6.2 In drum brackets 20 mm trough bolts with spring washers can be provided in place of 16mm bolts imbedded in the casting of the bracket at present.

6.3 Drum pin should be used of hard steel in place of MS pins to avoid frequent bending of pin.

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