

Engineering (Signalling) Instruction

ESI-03-03

S-60 Highway Grade Crossing Gate

Applicability

ARTC Network Wide



Audience	Main Points	Amendment Record
Signalling Engineers Signalling Maintenance Staff	<ul style="list-style-type: none">Installation and set up of the S-60 Crossing GateMaintenance of the S-60 Crossing Gate	First issue

Scope

This instruction is for Installation, Set up and Maintenance. It applies to all installed S-60 Highway Grade Crossing Gates.

Background

Poor set up and maintenance of the S-60 Barrier Mechanism can result in the barriers not descending as per requirement, barrier mechanisms must be accurately set up and maintained at all times.

On loss of power, the booms should descend using gravity, but due to inconsistencies in setting up, the barriers can remain vertical. Irregularities in set up include but are not limited to:

- Vertical torque set lower than specified
- Horizontal torque set lower than recommended, and
- The upper buffer stop set to allow excessive over travel.

Actions

Installation and Set Up

Preparation Action

1. Advise Network Controller before commencing work on equipment
2. Arrange worksite protection as necessary
3. Disable monitor
4. All work to be undertaken in accordance with environmental guidelines and procedures
5. Report environmental incidents or to get advice phone Enviroline 1300 550 402.

Issued by

Date

Manager Standards

12 Apr 2013

Actions

References

S-60 Highway Grade
Crossing Gate - Doc
No. 074050 –
Installation &
Maintenance config
mgt.

Recommended Battery and Wire Size

1. Check ohm reading of motor circuit – should not be more than 0.1ohm
Refer to Table 1 for recommended wire size
Section 4.2
2. Check recommended battery size for gate arm length
Refer to Table 2 for recommended battery quantities
"

Installation Procedure

1. Erect mast and base
Section 4.3
 - a. Junction box to be positioned on field side of post facing away from the barrier arms for both Invensys and GEC/United Group Cross arms.
 - b. Mounting hole for front and back flashing lights will be on field side of post facing away from the barrier arms for both Invensys and GEC/United Group Cross arms
2. Mount support clamp on mast
"
 - a. Support clamp casting to face 45 degrees from the field side towards track.
 - b. Top of casting should be 130cm above top of foundation
3. Prepare mechanism
"
 - a. Thread 90 degree flex conduit into back of gate cabinet
 - b. Insert 4 square head machine bolts into slots on the back of cabinet.
4. Clamp mechanism in place
"
 - a. Lift mechanism and set on top of the support.
 - b. Clamp to mast with clamps, nuts and washers.
5. Install boom arm supports
"
 - a. Mount gate arm supports with bolted on hubs over the keys on the main shaft ends.
 - b. Install main shaft nuts and washers **do not fully tighten** until after installing conversion bracket.
6. Install arm coupling or conversion bracket
"
 - a. Bolt to the arm support and **fully tighten** main shaft nuts.
7. Install flexible conduit
"
 - a. Thread coupling into base and install conduit to base and rear of cabinet.
8. Mount flashing lights, bell and signs
"
 - a. Refer to circuit book for detailing
 - b. Mount the required signs
9. Connect power to mechanism
"

- a. Refer to circuit book for detailing
 - b. Seal conduit opening
 - c. For defroster wiring refer to manual.
10. Install counterweight stud plates "
- a. Ensure the roller spacers are over the studs and in the arm support slot before mounting clamp bar and locking piece.
11. Install counterweights and gate arm as follows "
- a. Install counterweights – Install with the gate arm supports and counterweights with arm in the up position. See table 3 for number of counterweights
 - b. Raise counterweights to horizontal using the 'Maintenance Switch'
 - c. Manual ratcheting of the mechanism can be accomplished using the Bi-directional Lock Bar on the motor pinion shaft. The Lock Bar needs to be installed to maintain horizontal position
 - d. Install gate arm and Safetran shear bolts
- Refer to manual for quantity and positioning
12. Set horizontal torque and arm height "
- a. Set horizontal torque to 200 ± 20 foot-pounds,
 - b. Set arm height with horizontal buffer (upper position)
13. Raise and check vertical position of arm "
- a. Adjust the vertical position by rotating contact cam #7 on the main shaft
14. Adjust the vertical buffer (lower position) "
- a. Set to 8mm clearance from segment gear
15. Set vertical torque "
- a. Determine vertical torque limits as per Table 3
16. Adjust descending time "
- a. Recommended descend time is between 11-13 seconds.
 - i. Adjust with Coarse Snub Fuse in the 'C' position and R-29 Fine Snub Adjustment band in the lower (faster) position of the resistor.
 - b. Re-check the descend time
 - i. Move fuse to the left to increase or right to decrease descent time.
 - c. Use the Fine Snub Adjustment resistor to fine tune desired descent time if required.

Hand Cranking of Gate Mechanism

1. Prior to commencing hand cranking, disconnect the power by opening the test links (AREMA terminals 4 & 5) and the gold nut on the main PCB. Section 4.3.4
- a. Place ratchet wrench with 7/16-inch socket over the hexagon shaft. The ratchet should be set in the direction to prevent its rotation backwards.
 - b. Place the Lock Bar on the motor output shaft. Do not engage the Lock Bar with the Reaction Pin. Rotate the Lock Bar to move the gate. Once the gate is in position slide the Lock Bar over the Reaction Pin and secure in place using the Cotter Pin.

Spring Buffer Adjustment

- | | |
|--|---------------|
| 1. Check external adjustable spring buffers for horizontal gate arm positioning and vertical protection of the assembly. | Section 4.3.5 |
| 2. Adjust the horizontal gate arm position - with arm horizontal | " |
| a. Remove the buffer cap from the top buffer | |
| b. Loosen the locking ring and thread buffer into gate housing to raise the gate arm. | |
| 3. Adjust the vertical gate arm position buffer – with arm vertical | " |
| a. Remove the lower buffer cap | |
| b. Loosen the locking ring and adjust the buffer so that there is a 8mm clearance. | |
| c. Tighten locking ring and install buffer cover. | |

Counterweight Guidelines

- | | |
|---|---------------|
| 1. Ensure correct counterweight and torque is applied for either fibreglass or Aluminium gate arms. | Section 4.3.6 |
|---|---------------|
- Refer to Table 3

Torque Adjustment (Using Spring Scale Pt# 073000-16)

- | | |
|--|---------------|
| 1. Ensure correct horizontal torque is applied | Section 4.3.7 |
| a. Follow horizontal Torque Adjustment as detailed below but replace Torque Wrench with Spring Scale. | |
| 2. Ensure correct vertical torque is applied | " |
| a. Follow vertical Torque Adjustment as detailed below but replace Torque Wrench with Spring Scale. Spring Scale readings and locations are listed in the Torque Tables in table 3 | |

Torque Adjustment (Using Safetran Torque Wrench)

(REFER TO CAUTION NOTE BELOW)

- | | |
|--|-----------------|
| 1. Ensure correct torque readings | Section 4.3.8 |
| a. Torque wrench measurements to be taken from the ½ inch hexagon end of the motor shaft. | |
| 2. Ensure correct horizontal torque is applied | Section 4.3.8.1 |
| a. Open the gate house cover and lower the gate to full horizontal position by opening the gate control gold nut TB-1. | |
| b. Once fully horizontal the gold test nuts on terminals 4 and 5 can be opened to remove all power to the PCB. | |
| c. Install the S60 Lock Bar orientated to keep the gate up and manually lift the gate arm around 5 degrees from horizontal. The lock bar will hold the gate in position. | |
| d. Place a 7/16-inch open-ended wrench on the extended motor shaft. Rotating the wrench slightly will enable the Lock Bar to be removed. | |
| e. Install the Safetran Torque Wrench to the pinion end of the motor shaft and slowly lower the torque wrench to rest against the cover. Record the torque value. | |
| f. Continue to take 5 more horizontal readings as follows: | |

- i. Rotate the brake end of the motor shaft slightly so the torque wrench can be removed
- ii. Rotate the torque wrench 60 degrees and reinstall
- iii. Lower the torque wrench to the cover edge and record the torque value
- iv. Repeat until 1 full revolution of the output shaft has been checked.
- v. The lowest reading recorded is the horizontal position.

The use of a gate arm protection device may require a higher horizontal torque setting to keep the arm horizontal. If done, add final checks of:

- i. Horizontal torque does not exceed 250 foot-pounds
- ii. Gate up current does not exceed 15 amps
- iii. Snub adjustment provide acceptable descent time
- iv. Vertical torque is within specified limits
- v. Increased gear and brush maintenance may be required. Clean gears and reapply AeroShell #7 or equivalent grease when signs of wear are evident. (MSDS for AeroShell 7 can be found in ChemWatch)

3. Ensure correct vertical torque is applied

Section 4.3.8.2

- a. Make sure the torque wrench has been removed from the output shaft and the lock bar has been installed to keep the gate up.
- b. Close the test links on terminals 4 and 5 allowing the PCB to power up
- c. Close the Gold Nut on the PCB TB-1 and the gate should go to the vertical position.
- d. Once the gate is in the vertical position, remove power to the gate by first opening the test links on terminals 4 and 5 and then opening TB-1. The lock bar will hold the gate in the vertical position.
- e. Place a 7/16-inch open-ended wrench on the extended motor shaft on the brake end of the motor. Rotating the wrench slightly will enable the Lock Bar to be removed.
- f. Install the Safetran Torque wrench to the pinion end of the motor shaft and slowly lower the torque wrench to rest against the cover. Record the torque value.
- g. Take 5 more vertical torque readings by rotating the brake end of the motor shaft slightly until the torque wrench can be removed
 - i. Then rotate the torque wrench 60 degrees and reinstall
 - ii. Lower the torque wrench to the cover edge and record the torque value
 - iii. Repeat this until 1 full revolution of the output shaft has been checked.
 - iv. The lowest reading recorded is the vertical torque
- h. To make a vertical torque adjustment with the gate in the vertical position, reinstall the lock bar to keep the gate up, move the counterweights in or out to increase or decrease the torque and tighten the nuts
- i. Recheck the torque if needed but note that you just rotated the motor output shaft one turn and lowered the gate arm about 2 degrees.
- j. Remove the 7/16-inch wrench, torque wrench and lock bar and allow the gate to drop to horizontal by gravity.

- k. Close the test links on the terminal board 4 and 5 and then close TB-1 and the gate should go to the vertical position.

CAUTION

COMMERCIALLY AVAILABLE TORQUE WRENCHES SHOULD NOT BE USED TO ADJUST HORIZONTAL AND VERTICAL TORQUES, AS THEY ARE NOT DESIGNED TO ACCOUNT FOR THE 240:1 GEAR RATION OF THE DRIVE TRAIN.

(See type approval for Invensys Rail Torque Wrench Kit - part number 070981-X)

Contact Adjustments

1. Ensure correct contact adjustments

Section 4.3.10

Refer to Table 4

- a. Two contacts are required for gate operation (positions 6 & 7) and two contacts (positions 8 & 9) are factory adjusted and may be used as indicated in the table below.
- b. The contact opening can increase with use and should be checked periodically and adjusted if required. The openings should not exceed 1.5mm.
- c. Set the contact opening to where there is a light drag on a 1.5mm gauge. Always check contact operation after adjustment to be sure there is square contact and a good wiping action when the contact closes.
- d. Tension pressure of closed contact should be between 800g – 1.3kgs.

Auxiliary (Sidewalk) Arms (if applicable)

1. Ensure correct Auxiliary Arm adjustment

Section 4.3.11

- a. Lower the main gate arm to horizontal position.
- b. Loosen the four setscrews from the sidewalk arm gear
- c. Raise or lower the sidewalk Auxiliary Arm to the level horizontal position.
- d. Tighten the four cap screws
- e. Test the gate operation.

Final Inspection

1. Conduct a final inspection to ensure crossing barrier operates as per requirements

Section 4.3.12

- a. Voltage at terminal posts 4 & 5- Should be no less than 11 or more than 16 volts DC.
- b. Check for possible grounds.
- c. Check voltage and current during operation.
 - i. Voltage should not drop below 11 volts during gate up cycle.
 - ii. Gate up current should be 6-15 amps (longer arms require more current).

- iii. Power down current should be 6-15 amps.
- d. Check clearing and descending times.
 - i. Clearing time varies with length of arm but should be between 6 and 10 seconds.
 - ii. Descending time with power down is between 10 and 15 seconds.
 - iii. Descending time without power down - Disable the power down circuit by blocking contact #6 with a plastic card and open Gold Test Link on PC Board. The descent time should not be more than 20 seconds.
- e. Check terminal board contacts. Check clearance, square contact and wiping action
- f. Brake air gap - using Air Gap Tools (part numbers 074070-C & 074070-D *included within Maintenance & Installation Kit*) verify air gap is no less than 4mm and no more than 5mm.

Table 1

Distance from Battery Terminals to Mechanism Terminals	Size of Soft Drawn Copper Wire to use
Up to 18 meters (32 meters of wire)	2.5mm
From 18 to 32 meters (64 meters of wire)	4mm

Table 2

Gate Arm Length in Meters	Number of Cells		
	Lead	Nickel Iron	Nickel Cadmium
Up to 7	6	9	9
7 to 12	7	11	11

Table 3

Fibreglass and Fiberglass/Aluminium Gate Arm Counterweights and Vertical Torque										
Counter-weights mounted on one Support Arm	Gate Arm Length in Meters	Counterweights Required		Stud Plate 070757		Distance "X" in meters	Scale Reading *1		Torque Range *1	
		Std.	Short	Std.	Short		Min. (ft-lb)	Max. (ft-lb)	Min. (ft-lb)	Max. (ft-lb)
	3.6 – 4.6	1	3	-26X	-30X	1.5	30	35	175	205
	4.8 – 6.1	2	5	-26X	-30X	1.5	35	37	175	210
	6.4 – 6.7	3	7	-26X	-30X	1.5	35	38	175	210
	7.0 – 8.2	4	10	-26X	-30X	1.5	38	46	190	230
	8.5 – 9.8	5	10	-26X	-30X	1.8	39	44	235	260
	Counter-weights mounted on two Support Arm	10 - 11	6	13	-26X(2)	-30X(2)	2.1	41	48	260
11.2 – 12.2		7	17	-26X(2)	-30X(2)	3.0	34	38	300	350

*1 – Safetran Torque Wrench (Calibrated for both inch-pound and foot-pound readings through the 240:1 gear reduction)

The values listed above are approximate as there are differences between various Gate Arm Manufacturers

Table 4

Terminal Board Position Number	Contact Closed with Gate Arm at	Function of Contact
6	70 degrees – 90 degrees	Power Down Control
7	0 degrees – 89 degrees	Power Up Control
8	83 degrees – 90 degrees	Spare (Flashing Light Control)
9	5 degrees – 90 degrees	Spare (Bell Control)

Table 5: Tools supplied with each gate mechanism

Description	Part Number
S-60 Maintenance & Installation Kit	074050-X

Table 6: Additional tools required

Description	Part Number
Invensys Rail Wrench Kit	070981-X
Contact Spring Scale	073000-16

Maintenance

Periodic Lubrication

During the Signal maintenance inspection of the S-60 Level Crossing barrier equipment, the Signal Engineer or approved signal staff is to:

1. Ensure gears are coated with a thin film of all temperature grease (such as AeroShell 7) at 6 month intervals depending on the number of operations (MSDS for AeroShell 7 can be found ChemWatch)
2. Clean thoroughly and re-apply grease every two years or when signs of wear are present.

Refer to section 5.3 of S-60 Highway Grade Crossing Gate – Doc No. 074050 – Installation & Maintenance for detailing.

Periodic Inspection

During the Signal maintenance inspection of the S-60 Level Crossing barrier equipment, the Signal Engineer or approved signal staff is to:

1. Ensure air vents are unobstructed
2. Ensure flexible conduit between gate mechanism and junction box is sealed
3. Ensure an annual inspection of the brushes and commutator is conducted.

Refer to section 5.4 and 5.5 of S-60 Highway Grade Crossing Gate – Doc No. 074050 – Installation & Maintenance for details.