



Good Gate Inc.

Accelerated Cycle Testing

84in High Carriage Gate

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1 Background

The Good Gate Inc. carriage gate is designed to meet the requirements outlined in ASME A17.1/ CSA B44 section 5 for residential elevators.

Although there is no requirement for the number of cycles that a carriage gate must undergo in order to be compliant with the code Good Gate Inc. has undertaken accelerated cycle testing to ensure that the design and fabrication of this product is robust.

2 Test Set Up

The test set up is comprised of an 84in tall carriage gate with 4 panels and the corresponding tracks. The gate was operated using an common industry ball screw operator that is readily available. This was done to assess how it would interact with such a device as Good Gate expects that roughly 40% of the gates produced will be coupled to an operator of some kind.

An OMRON smart relay was used to provide simple timed pulses to the gate operator. Pulses were initially set at 60 seconds on and 60 seconds off but adjustments were made once it was determined that this interval was far too long and as a result a duration of 12 seconds on and 12 seconds off was used for the majority of testing.

A simple contact switch was also installed to allow for accurate counting of completed cycles in the OMRON smart relay.

A picture of the test set up can be seen in the figures below.





3 Procedure

The test procedure involves the following steps:

1. Set up gate with operator, as per installation guide
2. Check that operation is smooth and free from any binding
3. Adjust operator speed and travel to allow for smooth operation with full travel of gate panels
4. Monitor gate operation for any changes in noise, smoothness of operation, or other indications of failure
5. Complete at least 3 years of simulated life (8 cycles per day X 365 days X 3 years = 8760 cycles)
6. After achieving desired cycles or failure check operation of gate manually and note differences between initial operation and after cycles.
7. Remove panels from tracks and inspect for marking, damage, and any other concerns
8. Load test up to 75lb on combination of panel 3 and 4 to check for continued code coimpliance
9. Take pictures and document
10. Decide whether to continue testing or halt

4 Acceptance Criteria

Acceptance criteria for the test comprise the following:

- Achieve at least 2 years worth of cycles without any intervention, failure, or other significant concern
- No significant failure point observed or safety issue presented after cycles are complete
- Gate panels should not deflect more than 0.75in when 75lb load is applied on a 4inx4in area at the mid point of a panel

5 Results

During initial testing the operator itself had numerous issues being able to operate consistently. Although the manufacturer explicitly states that lubrication on the main drive mechanism is not required the unit had trouble operating even without the gate attached. As a result, lubrication was added and this improved the reliability of operation markedly.

The gate operated for 11,407 cycles before being stopped for inspection and load testing. This equates to roughly 4 years of accelerated life using 8 cycles per day.

An intervention was required at roughly 8000 cycles when a scraping sounds was observed. Upon inspection the screw that goes through the slot on Panel #4 in inserts to Panel #3 was starting to dig in to the surface of the middle cross piece on panel #4. Once the screw was adjust to have slightly more clearance the sound went away and a further 3,407 cycles without any incident or intervention. Images showing this scoring can be seen below but no damage to the screw was observed.



There did not appear to be any significant change in the overall noise level of the gate operation during the cycle testing.

During disassembly and inspection there were several points of minor rubbing that were noticed but nothing that was significant or considered a failure.

Images of various areas of the gate panels are shown below.



As part of the assembly there is a low friction polymer film at the bottom of each panel. One concern during the design stages was whether this film would hold up well over numerous cycles. An image of the worst panel is shown below and as can be seen the film is still intact on the running surfaces. There is some degradation on the bottom of one edge but it is believed this can be attributed to some debris in the lower sill/ track and it did not affect performance in an appreciable way. Further, this film is easy to remove and then re-apply should it become a problem over the life of operation.



The wheels on panel #4 had significant black powdery residue around them where this was not present on any others. It is inconclusive where this is coming from but it may be a result of some late stage drilling operations during set up that allowed for some aluminum drilling residue to be present near the end of the track for panel #4.



6 Post Cycle Load Testing

Panel #3 and #4 were used for load testing and an image of that set up is shown below. This is the same testing as completed on other panels during final prototyping and is only being used to confirm that panels will still meet the 0.75in deflection at 75lb load acceptance criteria required by ASME A17.1/ CSA B44 – 2016 safety code.



Deflection on the acrylic portion of the panel was 0.458in and on the aluminum outer edge it was 0.347in. Load was applied on a 4in x 4in wooden puck eccentrically.

7 Conclusions

All acceptance criteria have been met during accelerated cycle testing and the panels still meet the load/deflection requirements stated in the ASME A17.1/ CSA B44 safety code.

Good Gate will be continuing cycle testing to assess what failure modes present first but 4+ years without maintenance is more than sufficient to support this as a commercial product offering at this time.