



The Wireless Instrument Company

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### QarVision Installation in a 26-Floor Hotel

A QarVision Elevator Performance Monitor was installed on an elevator in a 4-star hotel. This is a gearless traction machine. The elevator is scheduled for modernization, but needs to keep running until the work begins. The elevator has 26 stops.



The QarVision unit is placed on the roof of the elevator car, along with the power supply and the antenna. The power supply is plugged into the 110 VAC trouble light outlet. A Remote Sensor Interface is located in the machine room with the antenna lying on the floor above the hoistway. The motor temperature sensor is not connected. The motor current sensor is clipped around one lead of the 3-phase power to the motor drive. The brake temperature sensor is left unattached to measure the temperature of the machine room. The door sensor was attached to the door frame inside the car using removable tape.

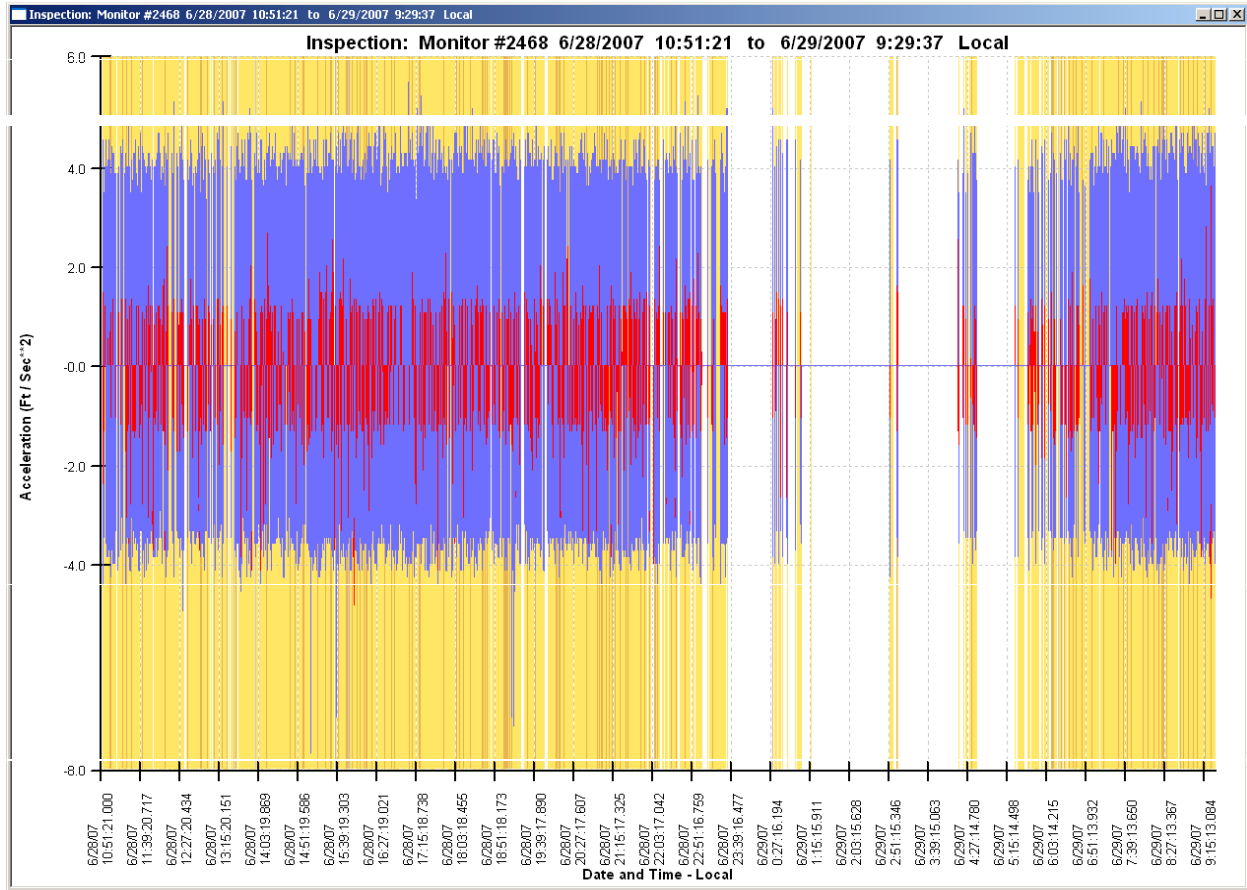


The Remote Sensor Interface communicates wirelessly with the QarVision unit. The units can communicate over the entire 26 floors.

The elevator was known to cause problems before the QarVision system was installed. In particular, the elevator would sometimes stop unexpectedly. This behavior was hard to observe since it happened infrequently and was not predictable.

The following graph (Figure 1) was recorded from the QarVision system over a period of about 23 hours. It shows the door opening and closing (orange hatched areas), the door hold open time (solid orange), and the acceleration and deceleration. The blue bars indicate the accelerations that are “significant”, and mark the start and stop of the car’s travel. The height of the bar is the maximum acceleration/deceleration, and the length of the bar is the duration. The red bars are accelerations that were not significant. These can be caused by passengers moving in the car, jerk, or rollback from the counterweight.

Acceleration Events	
	Longer than Min. Duration
	Shorter than Min. Duration
Door Events	
	Door Opening
	Door Open
	Door Closing
	Door Closing then Reopened
	Door Opening then Reclosed



**Figure 1**

The QarVision system can produce performance reports over any period of time that the unit was installed. This can be over the entire time the elevator has run, or over a single trip.

The following report was created during 23 hours of operation (Figure 2).

Elevator Monitor 2468			
Database: \\Home\main\TEMP\QarVision sample data\ july 6 - july 17.mdb			
Local Time: 6/28/2007 10:51:21 To 6/29/2007 9:29:38			
Monitor Description:			
Number of trips: 1670			
Number of door cycles: 1787    Number of door reopens: 106			
Total Run Time: 05:07:02    Duty Cycle (Run Time / Elapsed Time): 22.6%			
	Minimum	Average	Maximum
Door opening time (sec)	2.420	2.757	2.986
Door closing time (sec)	2.146	2.449	2.631
Door hold open time (sec)	0.121	8.113	451.221
Car start delay (sec)	0.418	2.973	29.664
Car stop to start open delay (sec)	-0.349	0.901	28.158
Acceleration magnitude (Ft / Sec**2)	2.541	3.748	7.757
Deceleration magnitude (Ft / Sec**2)	2.675	3.792	5.216
Motor temperature	N/A	N/A	N/A
Brake / Machine Room temperature (degrees F)	72.9	74.7	76.4

Motor current (amps) recorded periodically	2.6	7.8	53.0
Hydraulic pressure (PSI) recorded periodically	-14.9	136.6	273.2
Motor current (amps) maximum while moving	3.1	34.1	63.4
Hydraulic pressure (PSI) maximum while moving	-14.9	222.7	293.1

Trips per hour of the day: (This is the distribution of the trips the elevator made over the measured time)

Hour	# Trips
0:00	13 *****
1:00	2
2:00	2
3:00	3 *
4:00	17 *****
5:00	17 *****
6:00	48 *****
7:00	111 *****
8:00	126 *****
9:00	69 *****
10:00	16 *****
11:00	100 *****
12:00	71 *****
13:00	77 *****
14:00	102 *****
15:00	132 *****
16:00	123 *****
17:00	120 *****
18:00	122 *****
19:00	86 *****
20:00	111 *****
21:00	106 *****
22:00	71 *****
23:00	25 *****

Length of trip up in seconds: (This is the distribution of the length of trips. Most trips are of short distance.)

Secs	# Trips
3.0	16 *****
3.5	36 *****
4.0	4 ***
4.5	63 *****
5.0	5 ****
5.5	33 *****
6.0	52 *****
6.5	42 *****
7.0	31 *****
7.5	17 *****
8.0	35 *****
8.5	7 *****
9.0	46 *****
9.5	1
10.0	35 *****
10.5	6 *****
11.0	30 *****
11.5	4 ***
12.0	31 *****
12.5	5 *****

13.0	20	*****
13.5	7	*****
14.0	30	*****
14.5	7	*****
15.0	30	*****
15.5	5	****
16.0	33	*****
16.5	6	*****
17.0	21	*****
17.5	7	*****
18.0	12	*****
18.5	6	*****
19.0	11	*****
19.5	7	*****
20.0	12	*****
20.5	13	*****
21.0	21	*****
21.5	12	*****
22.0	10	*****
22.5	11	*****
23.0	3	**
23.5	7	*****
24.0	3	**
24.5	4	***
25.5	4	***

Length of trip down in seconds: (Most trips are of longer distance and go to the ground or first floors.)

Secs	# Trips
0.5	1
1.0	5**
3.0	28*****
3.5	38*****
4.0	15*****
4.5	102*****
5.0	11*****
5.5	32*****
6.0	43*****
6.5	24*****
7.0	28*****
7.5	24*****
8.0	43*****
8.5	9*****
9.0	39*****
9.5	10*****
10.0	36*****
10.5	11*****
11.0	36*****
11.5	11*****
12.0	34*****
12.5	10*****
13.0	18*****
13.5	11*****
14.0	22*****
14.5	4**
15.0	21*****

15.5	12	*****
16.0	19	*****
16.5	5	**
17.0	29	*****
17.5	7	***
18.0	18	*****
18.5	6	***
19.0	22	*****
19.5	10	*****
20.0	14	*****
20.5	4	**
21.0	15	*****
21.5	9	*****
22.0	11	*****
22.5	6	***
23.0	5	**
23.5	6	***
24.0	3	*
26.0	2	*

Duration of acceleration in seconds: (Accelerations are pretty consistent for the distance traveled.)

Secs # Accelerations

Secs	# Accelerations
0.2	1
0.3	12
0.4	21
0.5	1
0.6	1
0.7	2
0.8	3
0.9	2
1.1	2
1.2	4
1.3	38
1.4	70
1.5	10
1.6	2
1.8	41
1.9	95
2.0	83
2.1	27
2.2	6
2.3	2
2.4	30
2.5	67
2.6	67
2.7	38
2.8	50
2.9	65
3.0	65
3.1	198
3.2	509
3.3	291
3.4	21
3.5	2

Warnings:  
Local Time: 6/28/2007 12:18:35.0  
Door started opening while accelerating  
Local Time: 6/28/2007 18:15:11.0  
Door started opening while accelerating  
Local Time: 6/28/2007 20:54:55.0  
Door started opening while accelerating

# times closed door began to open, reclosed without opening fully: 29

Figure 2

There is a lot of information in this graph. Figure 3 shows one hour of operation of the elevator from the graph shown in Figure 1.

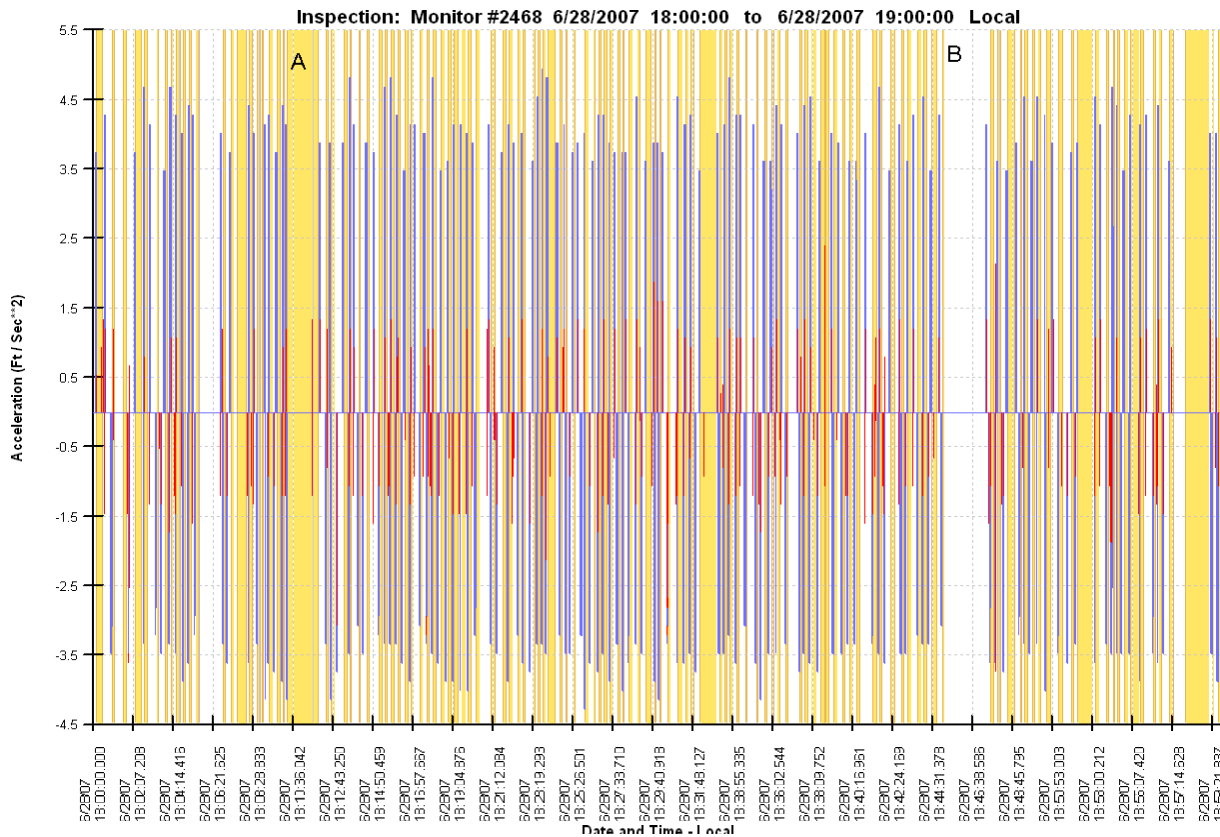


Figure 3

The following report was created during that one of operation (Figure 4).

Elevator Monitor 2468			
Database: \\Home\main\TEMP\QarVision sample data\july 6 - jul 17\july 6 - july 17.mdb			
Local Time: 6/28/2007 17:57:43 To 6/28/2007 19:00:02			
Monitor Description:			
Number of trips: 126			
Number of door cycles: 127    Number of door reopens: 8			
Total Run Time: 00:21:16    Duty Cycle (Run Time / Elapsed Time): 34.1%			
	Minimum	Average	Maximum
Door opening time (sec)	2.575	2.800	2.985
Door closing time (sec)	2.406	2.482	2.631
Door hold open time (sec)	0.206	7.004	80.203
Car start delay (sec)	0.477	3.083	26.577
Car stop to start open delay (sec)	-0.211	0.844	7.899
Acceleration magnitude (Ft / Sec**2)	2.541	3.680	4.280
Deceleration magnitude (Ft / Sec**2)	2.675	3.855	4.949
Motor temperature	N/A	N/A	N/A
Brake / Machine Room temperature (degrees F)	75.5	75.7	76.4
Motor current (amps) recorded periodically	2.8	9.3	41.0
Hydraulic pressure (PSI) recorded periodically	-7.5	142.8	265.8
Motor current (amps) maximum while moving	13.1	34.8	56.8
Hydraulic pressure (PSI) maximum while moving	95.6	224.7	275.7
Trips per hour of the day:			
Hour	# Trips		
----	-----		
0:00	0		
1:00	0		
2:00	0		
3:00	0		
4:00	0		
5:00	0		
6:00	0		
7:00	0		
8:00	0		
9:00	0		
10:00	0		
11:00	0		
12:00	0		
13:00	0		
14:00	0		
15:00	0		
16:00	0		
17:00	3  *		
18:00	122  *****		
19:00	1		
20:00	0		
21:00	0		
22:00	0		
23:00	0		
Length of trip up in seconds:			
Secs	# Trips		
----	-----		

3.0	4	*****
4.5	5	*****
5.5	3	*****
6.5	1	*****
7.0	2	*****
7.5	1	*****
8.0	4	*****
9.0	4	*****
10.0	2	*****
10.5	1	*****
11.0	2	*****
12.0	4	*****
12.5	1	*****
14.0	2	*****
15.0	2	*****
15.5	1	*****
16.0	1	*****
17.0	2	*****
17.5	2	*****
18.0	2	*****
20.5	1	*****
21.5	1	*****
22.0	2	*****
22.5	2	*****

Length of trip down in seconds:

Secs	# Trips	
----	-----	
1.0	1	***
3.0	2	*****
3.5	2	*****
4.0	3	*****
4.5	17	*****
5.5	1	***
6.0	3	*****
6.5	3	*****
7.0	5	*****
7.5	1	***
8.0	6	*****
8.5	1	***
9.0	2	*****
10.0	2	*****
10.5	2	*****
11.0	5	*****
12.0	1	***
12.5	2	*****
13.0	1	***
13.5	1	***
14.0	2	*****
15.5	1	***
16.0	4	*****
20.0	1	***
21.5	1	***
22.0	2	*****
22.5	1	***
24.0	1	***

Duration of acceleration in seconds:	
Secs	# Accelerations
0.3	3  *****
0.4	1  *
1.3	2  ***
1.4	5  *****
1.8	9  *****
1.9	9  *****
2.0	9  *****
2.1	2  ***
2.2	1  *
2.4	2  ***
2.5	2  ***
2.6	3  *****
2.7	1  *
2.8	9  *****
2.9	3  *****
3.0	5  *****
3.1	14  *****
3.2	32  *****
3.3	25  *****
3.4	2  ***
3.5	1  *

Warnings:  
Local Time: 6/28/2007 18:15:11.0  
Door started opening while accelerating

**Figure 4**

The “Door Hold Time” from the report shows a maximum of 80.203 seconds (point A on the graph in Figure 3). This is most likely from the elevator being parked on the first floor, waiting for passengers. It can also be caused by holding the door open.

The “Car start delay” shows a maximum of 26.577 seconds. This does not correspond to the longest period of inactivity from the graph (point B). In this system, any delay over 30 seconds is considered to be simply waiting for a call, and is not reported. In this case, the elevator was probably parked waiting for a call. The scheduling algorithm may have preferred other elevators in this group

The graphs shown in Figure 5 show 3 trips of the elevator. The second trip shows an interesting behavior. The car accelerated downward (A) for several floor and then decelerated (B). However, there appears to be a second set of downward acceleration and deceleration (D & E) before the door opened. The top graph shows the motor current that was recorded during these events. The second downward acceleration was greater in magnitude, and drew more current, at point D than the primary acceleration at point A. Some elevators have a limit switch at the terminal floors that force a second, more rapid deceleration. However, the trip immediately following this one was also in the same direction (downward), meaning that the elevator was not at a terminal floor.

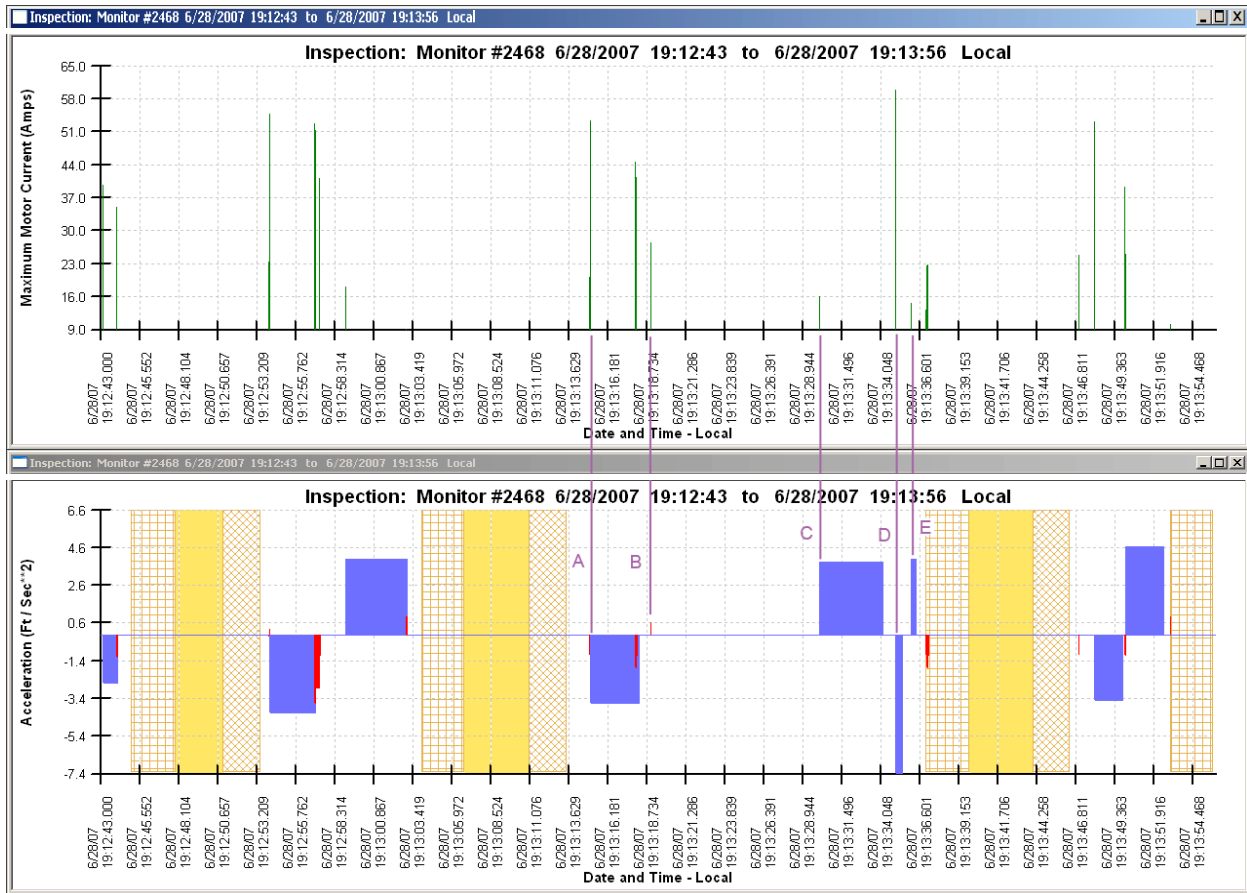


Figure 5

The QarVision system was run in a different mode for a few trips to determine the current drawn during the acceleration. This is shown in the graphs in Figure 6. The top graph records the actual acceleration/deceleration of the car, as well as the door opening and closing. The bottom graph shows the corresponding real-time current on one leg of the 3-phase power to the motor drive.

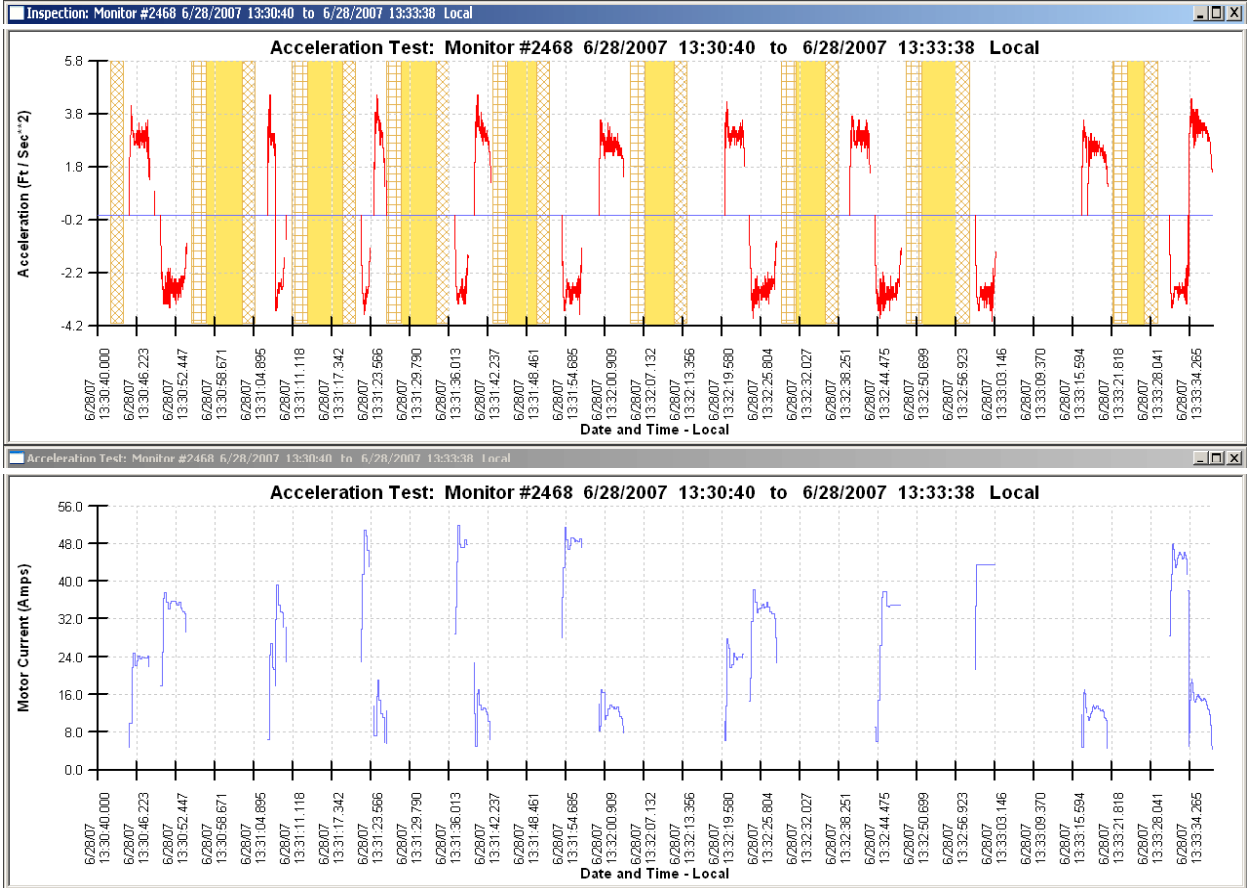


Figure 6

These are samples of the data that were recorded by the QarVision system at a 4-star hotel. If you would like to see more examples of what can be learned from the QarVision system, please contact us by phone or email.