Performance Contract

POST INSTALLATION ENERGY SAVINGS REPORT

EAST CENTRAL COLLEGE

REPORTING PERIOD:
INSTALLATION & YEAR 1

PRESENTED BY:
JOHNSON CONTROLS INC.
JANUARY 5, 2018

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January 5, 2018

Phil Pena

CFO, East Central College

1964 Prairie Dell Rd

Union, MO 63084

Re: Post Installation Report for East Central College

Dear Mr. Pena:

Attached please find the Post Installation Report for the Energy Savings Performance Contract (ESPC) between Johnson Controls and East Central College.

The following table shows the achieved installation period and projected Year 1 (October 1, 2017 to September 30, 2018) energy and cost avoidance:

Utility	Installation Period Energy Savings	Year 1 Projected Energy Savings
Total Cost Avoidance	$7,451	$84,554
Goal Savings	NA	$82,886
Savings Long/(Short)	$7,451	$1,668

Sincerely,

Don Flower

Energy Solutions Performance Engineer

Johnson Controls, Inc.

ACCEPTANCE

Following review and acceptance of this report, please scan and email a signed copy of this letter to:

donald.james.flower@jci.com

The Post Installation Report for the Energy Services Performance Contract is accepted by the undersigned.

Signature: _____ Date: _____

Title: _____

EAST CENTRAL COLLEGE

Johnson Controls

CONTENTS

EXECUTIVE SUMMARY

Project Overview

The performance contract between East Central College (ECC) and Johnson Controls, Inc. (JCI) consists of energy conservation strategies implemented by upgrading equipment and improving the efficiency of the lighting, water, building envelope and building control system, while paying for these improvements over a fifteen-year period with guaranteed cost avoidance. This was a collaborative effort between JCI and ECC building personnel to ensure that occupants of these buildings are comfortable and productive, while minimizing the energy and maintenance required to provide a quality building environment.

Saving Summary

Table 1 shows the achieved installation period savings per each facility improvement measure (FIM), and the dates each was substantially complete. Table 2 shows the Guaranteed versus Projected Year 1 (October 1, 2017 through September 30, 2018) energy and cost avoidance.

Table 1: Post Installation Cost Avoidance

Installation Period Savings						
FIM	Annual Savings	Daily Savings	Substantial Completion	Guarantee Start	Installation Days	Total $ Savings
Lighting	$62,605	$172	9/1/2017	10/1/2017	30	$5,146
Water	$6,013	$16	6/8/2017	10/1/2017	115	$1,895
Bldg Envelope	$1,611	$4	6/30/2017	10/1/2017	93	$410
Totals	$70,229					$7,451

It should be noted that installation period savings were not guaranteed.

Table 2: Year 1 Guaranteed vs Projected Cost Avoidance

Year 1 Guaranteed Cost Avoidance							
	KWH	$	Therms	$	kGal	$	Savings $
Measured Savings	771,059	$65,054	3,715	$2,379	918	$5,122	$72,556
Non-Measured O&M Savings							$10,331
Utility Savings Total	771,059	$65,054	3,715	$2,379	918	$5,122	$82,886

Year 1 Projected Cost Avoidance							
	KWH	$	Therms	$	kGal	$	Savings $
Measured Savings	784,410	$66,181	3,842	$2,421	1,008	$5,621	$74,223
Non-Measured O&M Savings							$10,331
Utility Savings Total	784,410	$66,181	3,842	$2,421	1,008	$5,621	$84,554

The projected savings for Year 1 is $1,668 over the guaranteed savings.

Table 3 displays the expected savings over the entire 15 year guarantee term. Year 1 through 15 are escalated at a rate of 3.31% per year as agreed upon in the performance contract.

Table 3: Term Savings

Year	Measured Electric Utility Avoidance*	Measured Natural Gas Utility Avoidance*	Measured Water Avoidance*	Operations & Maintenance Cost Avoidance**	Annual Project Benefits
1	$65,054	$2,379	$5,122	$10,331	$82,886
2	$67,207	$2,458	$5,291	$10,673	$85,629
3	$69,432	$2,539	$5,466	$11,026	$88,463
4	$71,730	$2,623	$5,647	$11,391	$91,392
5	$74,104	$2,710	$5,834	$11,768	$94,417
6	$76,557	$2,800	$6,027	$12,158	$97,542
7	$79,091	$2,892	$6,227	$12,560	$100,770
8	$81,709	$2,988	$6,433	$12,976	$104,106
9	$84,414	$3,087	$6,646	$13,405	$107,552
10	$87,208	$3,189	$6,866	$13,849	$111,112
11	$90,095	$3,295	$7,093	$14,308	$114,790
12	$93,077	$3,404	$7,328	$14,781	$118,589
13	$96,157	$3,516	$7,570	$15,270	$122,514
14	$99,340	$3,633	$7,821	$15,776	$126,570
15	$102,628	$3,753	$8,080	$16,298	$130,759
Total	**$1,300,775**	**$47,567**	**$102,407**	**$206,571**	**$1,657,320**

Conservation Strategies

A series of Facility Improvement Measures (FIMs) were implemented to achieve the energy and cost avoidance goals guaranteed under this contractual agreement. A brief summary of these FIMs is shown in Table 4.

Table 4: Facility Improvement Measures

FIM	Annual Savings Guaranteed (Yr 1 Values)	M&V Option
Lighting	$64,715	Option A
Water	$6,196	Option A
Building Envelope	$1,644	Option A
O&M Savings	$10,331	Not Measured
Controls Upgrade	$0	Not Measured
Total Guarantee	$82,886	

Project Timeline

- February 6, 2017: Contract Date
- March 1, 2017: Approximate Project Start Date
- September 30, 2017: Project Completion
- October 1, 2017: Performance Period Start

YEAR 1 SAVINGS

Non-Measured Savings

Table 4 above summarizes the Measured (Option A) and Non-Measured savings associated with this project. The Operation and Maintenance (O&M) savings was determined based upon historical maintenance records and industry data of the new equipment. This savings is not measured, and only increases per the escalation rate in the contract of 3.31%. Additionally, the controls upgrade did not have any savings attached to it, and is not measured as well.

Measured Savings

The following measures were measured or verified to confirm savings will be achieved by East Central College.

- Lighting
- Water
- Building Envelope

Lighting Savings

The lighting scope is defined in Schedule 1 and the Lighting Appendix of the performance contract. During the post installation period the following measurement and verification activities were performed:

- FIM verification is based on pre/post wattage measurements, as well as:
  - Walkthrough inspection
  - As-built review
- Scope changes
  - There were no significant scope changes
- Completion dates
  - September 1, 2017

Lighting was measured, per Option A, Retrofit Isolation: Key Parameter Measurement, prior to and following installation. Table 5 summarizes the savings for this measure by comparing the guaranteed savings to the achieved savings. Achieved savings is calculated by inputting the measured wattage of the pre and post retrofit fixtures, to the savings model. The difference between the pre and post measurements, times the number of fixtures, agreed upon burn hours and contract rates (escalated in Yr 1 by 3.31%) result in the savings shown in Table 5. Additional savings detail has been included in Appendix A, and in the as built information provided to the college. Per Schedule 2 of the contract, this measure is the only one of the measured FIM's that will be measured and reported on in Year's 2 and 3.

Table 5: Lighting Savings Summary

Achieved Lighting Savings					
Performance Period	Guaranteed		Achieved		Savings
	kWh	$	kWh	$	Long/(Short)
Year 0	0	$0	63,007	$5,146	$5,146
Year 1	766,588	$64,715	779,939	$65,804	$1,088
Year 2					
Year 3					
	766,588	$64,715	842,946	70,949	$6,234

Water Savings

The water scope is defined in Schedule 1 and the Water Appendix of the performance contract. During the post installation period the following measurement and verification activities were performed:

- FIM verification is based on pre/post flow measurements, as well as:
  - Walkthrough inspection
  - As-built review
- Scope changes
  - There were no significant scope changes
- Completion dates
  - June 8, 2017

Water was measured, per Option A, Retrofit Isolation: Key Parameter Measurement, prior to and following installation. Table 6 summarizes the savings for this measure by comparing the guaranteed savings to the achieved savings. Achieved savings is calculated by inputting the measured flow of the pre and post retrofit fixtures, to the savings model. The difference between the pre and post measurements, times the agreed upon parameters (male/female population, number of flushes per fixture) and contract rates (escalated in Yr 1 by 3.31%) result in the savings shown in Table 6. Additional savings detail has been included in Appendix A, and in the as built information provided to the college upon project completion. Per Schedule 2 of the contract, this measure is measured one time, so no further measurement and verification will be done. The savings in Table 6 will be carried forward for the duration of the contract with the 3.31% escalation rate.

Table 6: Water Savings Summary

Achieved Water Savings							
Performance Period	Guaranteed			Achieved			Savings
	kGal	Therms	$	kGal	Therms	$	Long/(Short)
Year 0	0	0	$0	289	537	$1,895	$1,895
Year 1	918	1,705	$6,196	1,008	1,832	$6,775	$579
	918	1,705	$6,196	1,297	2,369	$8,670	$2,474

Building Envelope Savings

The building envelope scope is defined in Schedule 1 of the performance contract. During the post installation period the following measurement and verification activities were performed:

- FIM verification based on:
  - Walkthrough inspection
  - Infrared imaging showing the before and after thermal effects of the retrofit
- Scope changes
  - There were no significant scope changes
- Completion dates
  - June 30, 2017

Per Schedule 2 of the performance contract, there are no quantifiable measurements, and savings is stipulated. The savings shown in Table 7 will be escalated at 3.31% for the duration of the contract, and no additional verification activities are required. The pre and post imaging has been included in Appendix B of this report.

Table 7: Building Envelope Savings

Achieved Building Envelope Savings							
Performance Period	Guaranteed			Achieved			Savings
	kWh	Therms	$	kWh	Therms	$	Long/(Short)
Year 0	0	0	$0	1,139	512	$410	$410
Year 1	4,471	2,010	$1,644	4,471	2,010	$1,644	$0
	4,471	2,010	$1,644	5,610	2,522	$2,054	$410

UTILITY RATES

Per Schedule 2 of the performance contract, the energy rates utilized in the savings calculations are summarized in Table 8.

Table 8: Utility Rates

Fuel	Contract Rates	Yr 1 Escalation
Elec Summer	0.108	0.112
Elect Non-Summer	0.068	0.071
Natural Gas	0.610	0.630
Water	0.003	0.003
Sewer	0.002	0.002

The rates shown in Table 8 represent those used in the Savings Guarantee, Installation and Projected Year 1 Savings.

SUMMARY AND RECOMMENDATIONS

JCI is pleased to work with East Central College and allowed to be a part of this beneficial energy project, projected to save over $84,000 per year. JCI welcomes partnering with East Central College on any additional energy or mechanical service needs that may arise.

Recommendations are as follows:

- Adhere to all recommended maintenance of installed equipment
- Analysis of utility data to watch for additional areas of savings or concern

The final section summarizes the project's environmental impacts, and JCI commends ECC on embarking upon this project exemplifying a commitment to a more sustainable environment.

ENVIRONMENTAL IMPACT

Reduction in the electric and natural gas consumption at East Central College results in a positive environmental impact. Table 9 shows the expected Year 1 impact.

Table 9: Expected Year 1 Environmental Impact[1]

CO_2 sequestered by	18,362	tree seedlings grown for 10 years in an urban scenario
CO_2 sequestered by	153	acres of pine or fir forests
CO_2 emissions from	137	passenger vehicles
CO_2 emissions from	1,665	barrels of oil consumed
CO_2 emissions from the *energy* use of	61	homes for one year
CO_2 emissions from burning	4	coal railcars

[1] *Source:*

All carbon equivalencies extracted directly from the EPA website.

"Greenhouse Gas Equivalencies Calculator." Clean Energy. U.S. Environmental Protection Agency. <www.epa.gov/cleanenergy/energy-resources/refs.html> (January 24, 2011).

APPENDIX A: LIGHTING AND WATER SAVINGS DETAIL

APPENDIX B: BUILDING ENVELOPE IMAGING

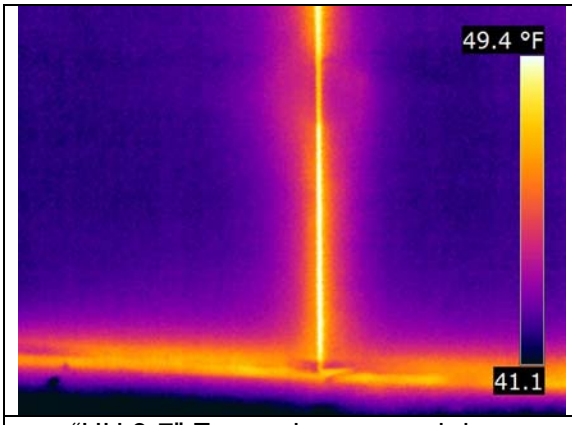
Post Lamp & Ballast Group	Quantity of Luminaires (Upgraded System)	Measured Average Pre-Retrofit Watts	Measured Average Retrofitted Watts
LED-NA-FXT100-NB(1): NA(0)	97	87	31
LED-14W-T8GL4-BP(2): NA(0)	1093	62	28
LED-18W-T8GL4-BP(3): NA(0)	589	86	54
LED-4W-FXT-NB(1): B-LED-1-4-DRV(1)	187	4	4
CFL-32W-MT-4P(1): B-CFL-2-32-ELECT(1)	203	36	36
HAL-50W-T-2PH(1): NA(0)	8	50	50
LED-8W-BX-DW(1): NA(1)	8	23	8
CFL-26W-MT-4P(1): B-CFL-2-26-ELECT(1)	136	27	27
LED-7W-MR16-GU5.3(1): NA(0)	20	50	7
LED-8W-T8L2-BP(1): NA(0)	2	19	8
LED-14W-T8GL4-BP(1): NA(0)	50	33	14
CFL-24W-BX-4PL(1): B-CFL-2-24-ELECT(1)	32	26	26
NA(0): NA(0)	409	17	17
CFL-26W-MT-4P(2): B-CFL-2-26-ELECT(1)	42	51	51
LED-25W-FXT-NB(1): B-LED-1-25-DRV(1)	18	25	25
LED-50W-FXT-NB(1): B-LED-1-50-DRV(1)	2	50	50
LED-NA-FXT90-NB(1): NA(0)	129	275	55
LED-13W-T8L3-BP(2): NA(0)	2	41	26
LED-7W-MR16-GU10(1): NA(0)	6	7	7
LED-10W-A-SI(4): NA(0)	5	92	40
CFL-42W-MT-4P(2): B-CFL-2-42-ELECT(1)	8	93	93
LED-8W-A-SI(1): NA(0)	3	8	8
FLU-F32T8(3): B-T8-3-32-IS-SP(1)	19	85	85
FLU-F32T8(2): B-T8-2-32-IS-SP(1)	228	59	59
FLU-F34T12(2): B-T12-2-40-MAG(1)	3	72	72
FLU-F32T8(1): B-T8-1-32-IS-SP(1)	4	31	31
CFL-23W-SPR-SI(1): NA(0)	14	23	23
LED-18W-T8GL4-BP(2): NA(1)	424	86	36
LED-9W-T8GL2-BP(3): NA(0)	14	55	27
LED-80W-FXT-NB(1): B-LED-1-80-DRV(1)	57	80	80
LED-5W-G25-SI(2): NA(0)	15	50	10
LED-NA-KIT50-NB(1): NA(0)	88	160	29
LED-16W-A-SI(1): NA(0)	55	26	16
CFL-20W-A-SI(1): NA(0)	56	20	20
LED-14W-T8GL4-BP(3): NA(0)	671	99	42
LED-100W-FXT-NB(1): B-LED-1-100-DRV(1)	147	100	100
LED-14W-T8GL4-BP(4): NA(0)	60	115	56
LED-8W-G25-SI(1): NA(0)	8	16	8
LED-22W-T8L4-BP(2): NA(0)	7	44	44
LED-17W-P38-SI(1): NA(0)	48	86	17
LED-22W-CORN-SI(1): NA(0)	55	42	22

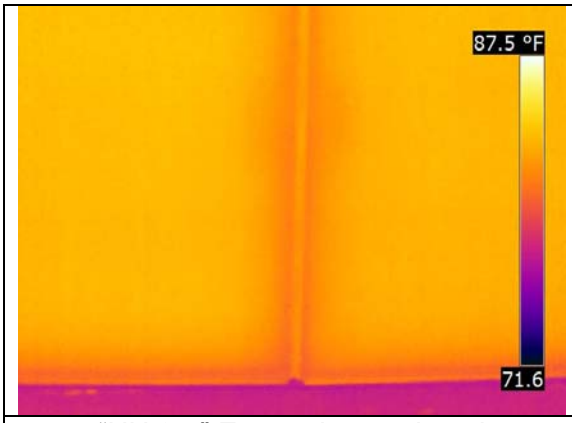
Post Lamp & Ballast Group	Quantity of Luminaires (Upgraded System)	Measured Average Pre-Retrofit Watts	Measured Average Retrofitted Watts
LED-NA-FXT100-NB(1): B-LED-1-150-DRV(1)	14	458	150
LED-165W-MHR-VERT(1): NA(1)	12	460	165
INC-500W-A-SIM(1): NA(0)	16	500	500
LED-14W-P30-SI(2): NA(0)	2	28	28
HAL-500W-TD-RSC(1): NA(0)	4	500	500
CFL-32W-MT-4P(2): B-CFL-2-32-ELECT(1)	36	68	68
LED-5W-G16-SII(230): NA(0)	1	3,450	1,150
LED-NA-KIT50-NB(1): NA(1)	87	171	23
CFL-18W-MT-4P(1): B-CFL-2-18-ELECT(1)	5	19	19
LED-NA-FXT100-NB(1): NA(1)	7	90	15
LED-NA-FXT90-NB(2): NA(0)	23	807	207
LED-8W-A-SI(2): NA(0)	1	16	16
CFL-16W-G30-SI(1): NA(0)	4	16	16
LED-NA-KIT50-NB(2): NA(1)	5	90	10
LED-9.5W-4PIN-HORZ(1): B-CFL-2-26-ELECT(1)	1	11	11
LED-8W-T8L2-BP(3): NA(0)	93	59	24
LED-15W-T5L4-MBP(2): B-T5HO-2-54-PS-DIM(1)	6	125	34
LED-18W-BX-DW(1): NA(1)	6	44	18
HAL-250W-T-SIC(1): NA(0)	4	250	250
LED-12W-PAR30-SI(1): NA(0)	13	16	12
LED-9.5W-4PIN-HORZ(2): B-CFL-2-26-ELECT(1)	3	21	21
CFL-13W-MT-4P(2): B-CFL-2-13-ELECT(1)	4	29	29
CFL-42W-SPR-SI(2): NA(0)	6	84	84
LED-14W-P38-SI(1): NA(0)	2	75	14
CFL-42W-SPR-SI(1): NA(0)	151	42	42
LED-15W-T8L4-BP(2): NA(0)	36	112	30
LED-16W-A-SI(2): NA(0)	3	40	32
LED-9W-T8GL2-BP(2): NA(0)	9	33	18
LED-7W-SI-A-DIM(1): NA(0)	4	40	7
LED-10W-A-SI(3): NA(0)	1	180	30
LED-36W-CORN-SI(1): NA(1)	16	129	36
LED-36W-CORN-SI-MED(1): NA(1)	7	129	36
LED-27W-CORN-SI(1): NA(1)	8	130	27

Achieved Savings Using Measurements										
Fixture Description	Pre-Retrofit Flow	Post-Retrofit Flow	Occupant Type	Daily Utilizations (Flushes or Minutes)	Number of Occupants	Days Used per Year	Water Savings (Gallons) = (Pre-Post) x Utilizations x Occupants x Days	Heating Savings (Therms)	Water $ Savings	Therm $ Savings
Toilets	2.99	2.28	FTE Student	1.4	2,379	160	374,057		$ 2,086.77	
Toilets	2.99	2.28	FTE Faculty	2.8	150	190	56,014		$ 312.49	
Toilets	2.99	2.28	FTE Staff	2.8	160	240	75,472		$ 421.04	
Urinals	1.27	0.92	FTE Student	0.6	2,379	160	80,735		$ 450.40	
Urinals	1.27	0.92	FTE Faculty	1.2	150	190	12,090		$ 67.45	
Urinals	1.27	0.92	FTE Staff	1.2	160	240	16,290		$ 90.88	
Lav Sinks	1.25	0.48	FTE Student	0.5	2,379	160	146,737		$ 818.61	$ 581.71
Lav Sinks	1.25	0.48	FTE Faculty	1	150	190	21,974	909	$ 122.58	
Lav Sinks	1.25	0.48	FTE Staff	1	160	240	29,606		$ 165.17	
General Us	2.12	1.39	FTE Student	0.25	2,379	160	69,625		$ 388.42	$ 276.02
General Us	2.12	1.39	FTE Faculty	0.5	150	190	10,426	431	$ 58.17	
General Us	2.12	1.39	FTE Staff	0.5	160	240	14,048		$ 78.37	
Showers	3.41	1.81	FTE Student	0.14	2,379	160	85,423		$ 476.55	$ 314.69
Showers	3.41	1.81	FTE Faculty	0.14	150	190	6,396	492	$ 35.68	
Showers	3.41	1.81	FTE Staff	0.14	160	240	8,618		$ 48.08	
Sprayers	2.50	2.50	Kitchen Sprayer	18	1	160				
Sprayers	2.50	2.50	Kitchen Sprayer	18	1	160				
						Totals	1,007,511	1,831.89	$ 5,621	$ 1,172

	Sinks			Showers		Flushometer Toilets			Urinals				
	Lavatory Sink	General Use Sink	Multipurpose Lav Sink	Wall Showers	Handheld Showers	3.5 gpf (or More)	1.6 gpf	1.28 gpf	2.0 gpf (or More)	1.5 gpf	1.0 gpf	0.5 gpf	0.125 gpf
Population Size in Scope	103	14	0	51	0	41	71	0	2	20	18	4	0
FEMP Sample Size	**10**	**6**	**0**	**10**	**0**	**9**	**10**	**0**	**0**	**8**	**7**	**3**	**0**
Total FEMP Measurements	**16**			**10**		**19**			**18**				
Percent of Total	**13.7%**			**19.6%**		**17.0%**			**40.9%**				
Quantity of Measured Fixtures	**10**	**6**	**0**	**10**	**0**	**9**	**11**	**0**	**0**	**8**	**7**	**4**	**0**

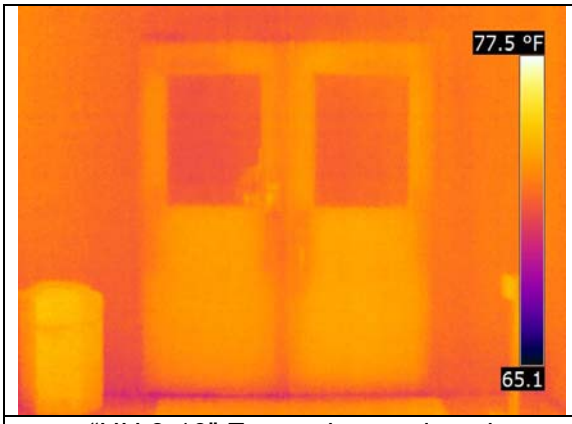
1. Hansen Hall

		
“HH 3-7” Energy loss around door		“HH 3-7” Recommend weather strip and door sweeps

		
“HH 3-7” Energy loss reduced		“HH 3-7” Door seals installed

Hansen Hall (cont.)

		
“HH 3-10” Energy loss around door		“HH 3-10” Recommend weather strip and door sweeps

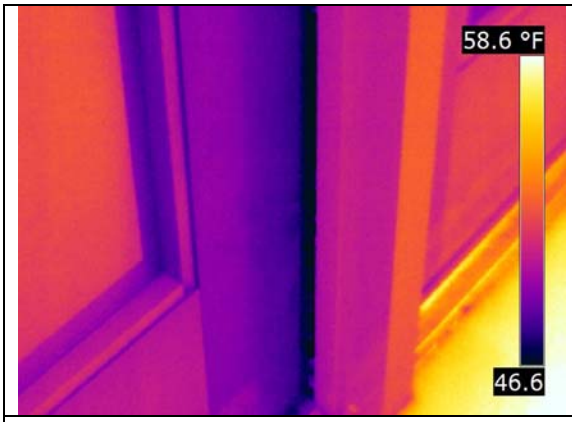
		
“HH 3-10” Energy loss reduced		“HH 3-10” Door seals installed

Hansen Hall (cont.)

		
“B” Energy loss around penetration		“B” Recommend sealant around penetration

		
“B” Energy loss reduced		“B” Sealant installed around penetration

2. Health Science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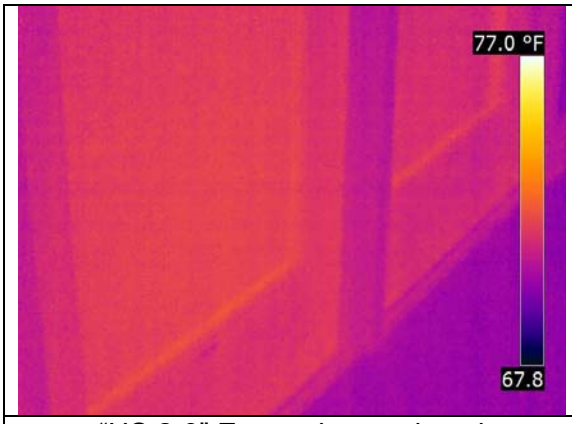		
“HS 2-3” Energy loss reduced		“HS 2-3” Door seals installed
		
“HS 2-2” Recommend door seals		“HS 2-2” Door seals installed