2017

Village of Lancaster

Submission of Detailed Energy Audit
Final Report
December 1, 2017

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1.0 EXECUTIVE SUMMARY

Danforth is pleased to submit this Detailed Energy Audit report to the Village of Lancaster.

We have gone to great lengths to provide the Village with as much detailed information as possible with this stage of the project development, with the end goal leading towards a successful energy performance contract with the Village of Lancaster. We are pleased to have been offered the opportunity to assist the Village in its quest in becoming more energy efficient and in upgrading not only its buildings, but its Village-wide street lighting as well.

Danforth has been working alongside the Village for months, with a singular goal of evaluating which direction we should focus our time on with the development of a clear path to energy savings for the Village of Lancaster. Through this time spent together, we tried to base our analysis and the development of energy reduction ideas upon the Village's financial and technical priorities and needs. Those priorities ultimately helped in the determination of the final opportunity presented in the Energy Performance Contract we are delivering to the Village as well as the final size and scope of this project.

We have provided a program that currently represents a final project worth $1,524,991 which will help generate $49,069 worth of energy savings and $60,174 of operations and maintenance cost avoidance, equaling a total of $109,244 of revenue in year one of the program.

These numbers were achieved through our focus on the upgrades of the following measures: retrofitting the Village-wide street lights to LED technology, interior and exterior lighting retrofits throughout the Village buildings, lighting control retrofits, building envelope improvements, boiler replacements, roof top unit replacements, installation of building management system upgrades and replacement of PTAC units with a roof top unit.

On behalf of Danforth's Client Solutions Group, and the entire Danforth organization, I thank the Village of Lancaster for their continued support and interest in assisting Danforth in our quest to present an energy performance contracting opportunity that will benefit the Village and its occupants for many years to come.

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2.0 BASELINE ENERGY DATA, UTILITY COSTS & RATE STRUCTURE

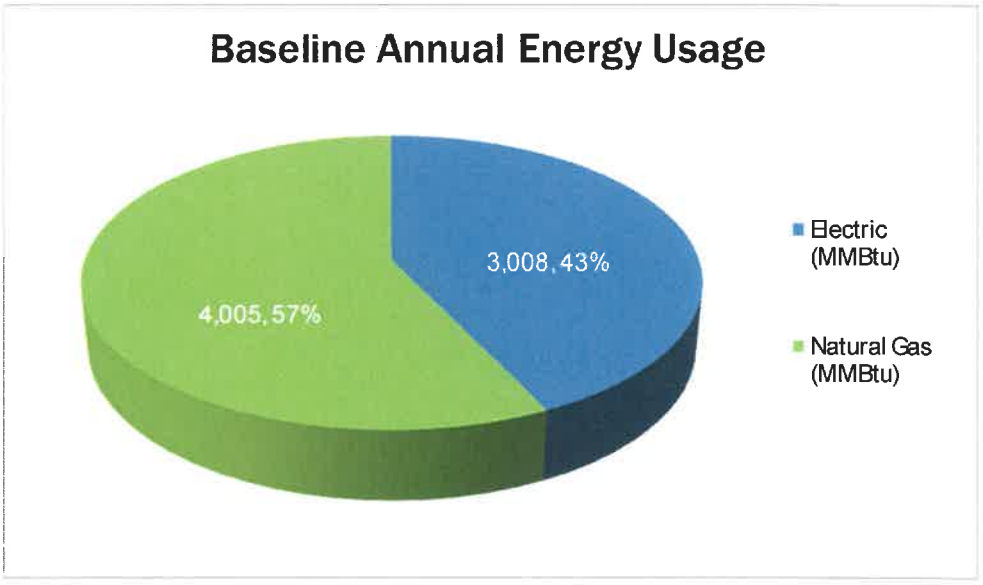
The tables below show baseline energy usage data for the Village of Lancaster. The electric baselines for each facility are based on electric and natural gas billing data from December 2015 to November 2016 as provided by the Village.

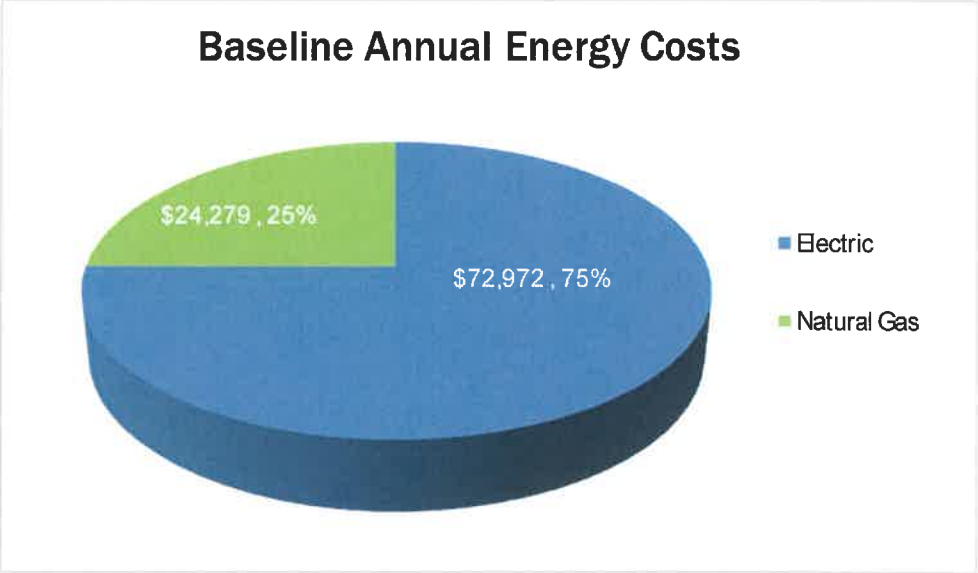
The average utility rates for each building, which are used to calculate the utility costs savings shown in the remainder of this report, are shown below.

Building	Building Area (SF)	Electric			
		Annual Usage (kWh)	Annual Costs	Demand Rate ($/kW)	Consumption Rate ($/kWh)
Street Lighting Account (#R2)		62,742	$ 4,536		$ 0.072
Street Lighting Account (#R3)		527,648	$ 38,143		$ 0.072
Municipal Bldg	21,282	136,953	$ 13,083	$ 9.35	$ 0.069
DPW	18,426	103,069	$ 9,996	$ 9.35	$ 0.067
Northend Fire Hall	4,653	36,080	$ 3,852	$ 9.35	$ 0.074
1 W Main Street		559	$ 271		$ 0.484
5 Aurora St		2,068	$ 415		$ 0.201
37 Central Avenue		2,062	$ 402		$ 0.195
Near 69 Lake Ave P13-1		483	$ 262		$ 0.542
Central & Brady Ave SGL		1,520	$ 368		$ 0.242
Central & Pleasant Ave		2,501	$ 466		$ 0.186
Central Ave & W Main St		1,004	$ 322		$ 0.320
N Aurora St @Pleasant		2,062	$ 422		$ 0.205
Near 34 Central Ave		2,636	$ 435		$ 0.165
TOTAL	**44,361**	**881,387**	**$ 72,972**	-	-

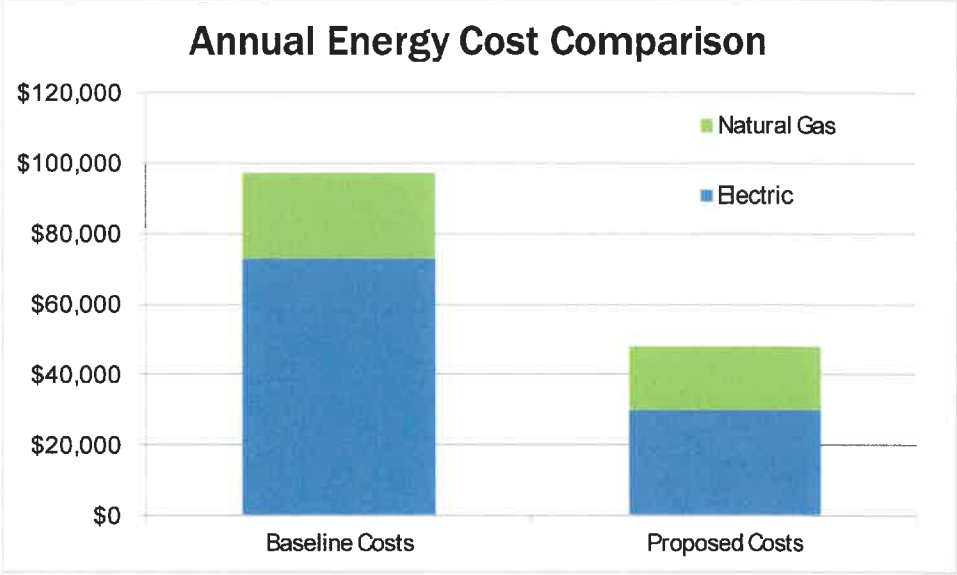
Building	Building Area (SF)	Natural Gas			Total Costs
		Annual Usage (therm)	Annual Costs	Average Rate ($/therm)	
Street Lighting Account (#R2)					$ 4,536
Street Lighting Account (#R3)					$ 38,143
Municipal Bldg	21,282	16,649	$ 9,932	$ 0.60	$ 23,015
DPW	18,426	20,717	$ 12,456	$ 0.60	$ 22,452
Northend Fire Hall	4,653	2,687	$ 1,891	$ 0.70	$ 5,743
1 WMain Street					$ 271
5 Aurora St					$ 415
37 Central Avenue					$ 402
Near 69 Lake Ave P13-1					$ 262
Central & Brady Ave SGL					$ 368
Central & Pleasant Ave					$ 466
Central Ave & WMain St					$ 322
N Aurora St @Pleasant					$ 422
Near 34 Central Ave					$ 435
TOTAL	44,361	40,053	$ 24,279	$ 0.61	$ 97,251

The chart below compares the electric and natural gas usage for the Village of Lancaster in common units of million Btus (MMBtu). Natural gas accounts for 57% of the total energy used in the Village.





The chart above compares the annual electric and natural gas costs for the Village. While electricity accounts for 75% of the overall utility budget, it represents only 43% of the annual energy usage in the district. This is due to the fact that electricity ($24.26 per MMBtu) is four times more expensive than natural gas ($6.06 per MMBtu) on a per unit basis.



The chart compares the baseline annual energy costs to the new annual energy costs under the proposed project. Danforth's comprehensive energy performance project, which includes converting the Village's existing street lights to LEDs, will reduce Lancaster's

overall annual energy costs by 50.5%. Details on the proposed measures which will generate these savings can be found in Section 4 of this report.

VILLAGE OF LANCASTER PERFORMANCE CONTRACT
PROFORMA 15 YEAR CASHFLOW
20 YEAR LIFE CYCLE PROJECTION

Year	Energy Costs	Assets				Liabilities					Net Annual Benefit	Cumulative Cash Flow
	Base Year Energy Costs	Energy Savings	Associated Savings (1)	Estimated Rebates & Incentives (2, 3)	Total Assets	Payment (4)	Performance Assurance	Service Contract	On-Going Services (5, 6)	Total Liabilities		
1	$97,251	$49,069	$60,166	$37,224	**$146,460**	($139,960)	($1,500)	$0	($1,500)	**($141,460)**	$5,000	***$5,000***
2	$100,169	$50,542	$61,971	$23,374	**$135,887**	($130,887)	$0	$0	$0	**($130,887)**	$5,000	***$10,000***
3	$103,174	$52,058	$63,831	$0	**$115,888**	($110,888)	$0	$0	$0	**($110,888)**	$5,000	***$15,000***
4	$106,269	$53,620	$65,746	$0	**$119,365**	($114,365)	$0	$0	$0	**($114,365)**	$5,000	***$20,000***
5	$109,457	$55,228	$67,718	$0	**$122,946**	($117,946)	$0	$0	$0	**($117,946)**	$5,000	***$25,000***
6	$112,741	$56,885	$69,749	$0	**$126,634**	($121,634)	$0	$0	$0	**($121,634)**	$5,000	***$30,000***
7	$116,123	$58,592	$71,842	$0	**$130,433**	($125,433)	$0	$0	$0	**($125,433)**	$5,000	***$35,000***
8	$119,607	$60,349	$73,997	$0	**$134,346**	($129,346)	$0	$0	$0	**($129,346)**	$5,000	***$40,000***
9	$123,195	$62,160	$76,217	$0	**$138,377**	($133,377)	$0	$0	$0	**($133,377)**	$5,000	***$45,000***
10	$126,891	$64,025	$78,504	$0	**$142,528**	($134,926)	$0	$0	$0	**($134,926)**	$7,602	***$52,602***
11	$130,697	$65,945	$80,859	$0	**$146,804**	($134,926)	$0	$0	$0	**($134,926)**	$11,878	***$64,479***
12	$134,618	$67,924	$83,285	$0	**$151,208**	($134,926)	$0	$0	$0	**($134,926)**	$16,282	***$80,761***
13	$138,657	$69,961	$85,783	$0	**$155,744**	($134,926)	$0	$0	$0	**($134,926)**	$20,818	***$101,579***
14	$142,817	$72,060	$88,357	$0	**$160,417**	($134,926)	$0	$0	$0	**($134,926)**	$25,490	***$127,069***
15	$147,101	$74,222	$91,007	$0	**$165,229**	($134,926)	$0	$0	$0	**($134,926)**	$30,303	***$157,372***
16	$151,514	$76,449	$93,737	$0	**$170,186**	$0	$0	$0	$0	**$0**	$170,186	***$327,558***
17	$156,060	$78,742	$96,550	$0	**$175,292**	$0	$0	$0	$0	**$0**	$175,292	***$502,850***
18	$160,741	$81,104	$99,446	$1	**$180,551**	$0	$0	$0	$0	**$0**	$180,551	***$683,401***
19	$165,564	$83,538	$102,429	$2	**$185,969**	$0	$0	$0	$0	**$0**	$185,969	***$869,370***
20	$170,530	$86,044	$105,502	$3	**$191,549**	$0	$0	$0	$0	**$0**	$191,549	***$1,060,919***
	Total	$1,318,516	$1,616,696	$60,605	$2,995,817	($1,933,398)	($1,500)	**$0**	($1,500)	($1,934,898)	$1,060,919	$1,060,919

Total Implementation Cost:	($1,524,991)	Total Estimated Utility Incentives:	$58,436	Cumulative Savings:	$1,060,919
Other Costs(Construction Interest):	($43,252)	Construction Period Escrow Interest (9):	$2,163	Net Present Value:	$666,557
Net Financed Investment:	($1,568,243)			Percent of Utility Savings	50.5%
Interest Rate (7):	2.80%			Guarantee Period(yrs):	3
Financial Term in Years:	15	Service Inflation Rate:	2%		
Annual Payment:	($139,960)	Energy Inflation Rate:	3%		
Simple Payback (years) (8):	14.2	Operational Savings Inflation Rate:	3%		

Notes:

1. *Associated Savings is defined as operational and maintenance cost sa*
2. *Total utility rebate incentives applied over years 1, 2.*
3. *Non-guaranteed estimated Rebates & Incentives include NYSEG incentives and Construction Period Escrow Interest*
4. *Payment represents an annual sum of periodic payments.*
5. *On Going Services are escalated at Service Inflation Rate.*
6. *Performance Assurance required during guarantee period only.*
7. *Interest Rate Subject to market adjustment prior to close.*
8. *Simple Payback = (Total Project Cost) / (First Year Energy Savings plus Associated Savings plus On-Going Services)*
9. *Construction interest based on 12 month funding to payment schedule.*
10. *Annual guarantee may not exceed Total Project Cost.*
11. *Annual guarantee amount is based on revenue neutral program.*

4.0 FACILITY IMPOVEMENT MEASURES (FIMS)

Overall FIM Summary Table

FIM #	Facility	Facility Improvement Measure	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentives	Simple Payback	Net Payback
1	Village-Wide	Retrofit Village Street Lighting with LEDs	$788,086	$29,971	$58,752	$36,540	8.9	8.5
2	Municipal Bldg	Interior and Exterior Lighting Retrofits	$30,939	$4,266	$62	$6,161	7.1	5.7
3	Municipal Bldg	Lighting Control Retrofits	$4,917	$34	$10	$0	111.9	111.9
4	Municipal Bldg	Building Envelope Improvements	$4,704	$237	$0	$0	19.9	19.9
5	Municipal Bldg	Install Condensing Boiler	$161,140	$3,374	$325	$4,000	43.6	42.5
6	Municipal Bldg	Rooftop Unit Replacements	$113,356	$474	$229	$750	161.4	160.3
7	Municipal Bldg	Install Building Management System	$15,390	$243	$31	$0	56.1	56.1
8	Municipal Bldg	Replace PTACs with Rooftop Unit	$86,114	$1,777	$174	$0	44.1	44.1
9	Northend Fire Hall	Interior and Exterior Lighting Retrofits	$9,442	$1,075	$19	$1,128	8.6	7.6
10	Northend Fire Hall	Building Envelope Improvements	$5,801	$203	$0	$0	28.5	28.5
11	DPW	Interior and Exterior Lighting Retrofits	$31,419	$3,727	$63	$6,857	8.3	6.5
12	DPW	Lighting Control Retrofits	$3,121	$47	$6	$0	58.2	58.2
13	DPW	Building Envelope Improvements	$19,699	$1,161	$40	$0	16.4	16.4
14	DPW	Rooftop Unit Replacements	$56,751	$193	$114	$0	184.8	184.8
15	DPW	Boiler Replacement	$169,112	$2,288	$341	$3,000	64.3	63.2
16		Detailed Audit Fee	$25,000	$0	$0	$0	-	-
		TOTAL	$1,524,991	$49,069	$60,166	$58,436	14.2	13.4

Notes: Danforth has carried a safety factor of 5% on all energy savings. The savings calculations shown in Section 6 reflect the full calculated savings, but the table above and the individual measure tables shown in the following pages include the 5% safety factor.

Net Simple Payback includes estimated prescriptive rebates available under NYSEG's Commercial and Industrial Rebate Program.

4.1 RECOMMENDED MEASURES

FIM #1 – Interior Lighting Upgrades

Concept

Street lighting costs are comprised of both electricity usage and monthly maintenance fees as charged by the utility company. Newly approved state legislation has opened the opportunity for government entities to purchase the street lighting from the utility companies, offering them the ability to retrofit the street lights with energy efficiency LED lighting. This also relieves them of the costly monthly maintenance fees.

Existing Conditions

Typical Decorative Post Top and Cobra Head Fixtures

The Village of Lancaster's existing street lighting system has a total of 838 lights and is made up of a combination of high pressure sodium cobra head and post top fixtures. The high pressure sodium lamps emit a yellow tinted light, making it difficult to distinguish colors.

The entirety of the Village's street lighting equipment is currently owned and maintained by NYSEG. The Village's monthly bills for their street lighting accounts include charges for the electricity used to operate the lights as well as additional fees to maintain the equipment. These maintenance fees account for nearly 60% of the total street lighting bill.

Recommendations

Danforth proposes to facilitate the purchase of the Village's street lighting inventory from NYSEG and enable the conversion to LED. Once the Village accepts NYSEG's proposed purchase price for the equipment the sale will have to be approved by the Public Service Commission. Upon completion of the sale of the equipment, the Village will be relieved of NYSEG's monthly maintenance fees and can begin the process of retrofitting the lights.

Scope of Work

Village of Lancaster Street Lighting

Total Number of Street lights	**838**	**Lights**

Lighting Types and Count

Lights	Power (W)	# lamps/Poles/Brkts	Types
R2			
50 W HPS Light	50	4	Lamps
250 W HPS Light	250	17	Lamps
250 W MHL Light	250	19	Lamps
175 W MHL Light	175	16	Lamps
R3			
100W MRC Cobrahead Light	100	148	Lamps
175W MRC Cobrahead Light	175	209	Lamps
250W MRC Cobrahead Light	250	6	Lamps
400W MRC Cobrahead Light	400	4	Lamps
50W HPS Cobrahead Light	50	10	Lamps
70W HPS Cobrahead Light	70	146	Lamps
100W HPS Cobrahead Light	100	176	Lamps
150W HPS Cobrahead Light	150	35	Lamps
250W HPS Cobrahead Light	250	16	Lamps
400W HPS Cobrahead Light	400	27	Lamps
250W MHL Cobrahead Light	250	3	Lamps
150W HPS Flood Light	150	1	Lamps
400W HPS Flood Light	400	1	Lamps
Standard Poles		52	Poles
Steel Poles		6	Poles
Aluminium Poles - pdstl Mounted		1	Poles
Standard Bracket - 16' and Over		23	Brackets
Bracket Allowance		20	

A summary of the Village's street lighting inventory is shown above. Danforth will remove the Village's existing street lighting fixtures and replace them with LED lamps as shown in the itemized street lighting survey in Section 5 of this report.

Savings Analysis

Lighting energy savings is derived from a reduction in electric usage. Electric Usage Savings are calculated by subtracting the proposed fixture wattage from the existing fixture wattage and multiplying that difference by the annual hours of operation. Electric cost savings are then determined by multiplying the predicted kWh reduction by the base year unit energy rate for kWh.

The complete methodology for determining energy savings for this measure is shown in the street lighting survey in Section 5 of this report.

Facility Improvement Measure Summary

FIM #1 – Retrofit Village Street Lighting with LEDs					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Village-Wide	$ 788,086	$ 29,971	$ 58,752	$ 36,540	8.5
TOTAL	$ 788,086	$ 29,971	$ 58,752	$ 36,540	8.5

FIMs #2, 9 & 11 – Interior and Exterior Lighting Retrofits

Concept

Lighting typically represents a major portion of a facility's electrical usage. Given the continuous hours of operation, this normally contributes to the peak electric demand each month. Having old, inefficient lighting can waste both energy and money. Taking steps to improve the efficiency of lighting systems will reduce both the total electric energy used and the peak electric demand. Lighting retrofit projects often improve the facility aesthetically by providing brighter, whiter light and operating more quietly than the old lighting systems, while also providing operational savings due to the longer useful life.

Existing Conditions

Existing Municipal Building T12 Lighting

The interior spaces of the Village of Lancaster facilities are primarily illuminated using linear fluorescent troffer and surface mount fixtures with T8 and T12 lamps with electronic ballasts. There are also a number of recessed can fixtures which use either incandescent or compact fluorescent lamps.

Building exteriors and parking areas are illuminated using a combination of wall packs, flood lights and recessed fixtures which utilize metal halide, mercury vapor, high pressure sodium or incandescent lamps.

Recommendations

Sample Parking Lot LED Lighting Upgrade

Danforth performed detailed lighting surveys of the interior and exterior lighting systems in the Village of Lancaster Municipal Building, Northend Fire Hall and DPW Building. Our project includes a comprehensive retrofit of all of the interior fixtures in each facility with new 13W linear LED lamps as the primary lamp type. The LED retrofit scope includes removing the existing lamps and ballast, rewiring the fixture's tombstones, installing a new socket bar and installing the new LED lamps with integrated drivers.

All new LED lamps and fixtures are rated for at least 50,000 run hours before their output is reduced to 70% of their initial output.

Danforth's proposed project also includes replacing all of the existing exterior light fixtures in the Village with new LED lamps and fixtures. These new lighting systems will significantly reduce the Village's energy consumption, improve buildings and grounds aesthetics (as shown above) and reduce maintenance requirements due to their long lifespan.

Scope of Work

Danforth will provide all labor and materials for the following lighting upgrades in the Village of Lancaster. The quantity of lighting fixtures recommended for upgrades at each facility are shown below.

Municipal Building – 273 interior fixtures, 7 exterior fixtures

Northend Fire Hall – 54 interior fixtures, 13 exterior fixtures

DPW – 179 interior fixtures, 14 exterior fixtures

Detailed lighting surveys can be found in Section 5 of this report.

Savings Analysis

Lighting energy savings is derived from a reduction in electric usage, a reduction in electric demand, and interactive effects with heating and cooling systems. Typically, there is an increase in heating load and a decrease in cooling load associated with the installation of more efficient lighting systems. Baseline utility rates are used for calculating energy cost savings.

Electric Demand Savings are calculated by subtracting the proposed fixture wattage from the existing fixture wattage. Electric Usage Savings are calculated by multiplying that difference by the annual hours of operation.

Electric cost savings are then determined by multiplying the predicted kWh and kW reductions by the base year unit energy rates.

The complete methodology for determining energy savings for these measures is shown in the lighting surveys in Section 5 of this report

Facility Improvement Measure Summary

FIMs #2, 9 & 11 – Interior and Exterior Lighting Retrofits					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 30,939	$ 4,266	$ 62	$ 6,161	5.7
Northend Fire Hall	$ 9,442	$ 1,075	$ 19	$ 1,128	7.6
DPW	$ 31,419	$ 3,727	$ 63	$ 6,857	6.5
TOTAL	$ 71,800	$ 9,068	$ 145	$ 14,146	6.3

FIMs #3 & 13 –Lighting Control Retrofits

Concept

Lighting controls, such as occupancy sensors can improve the functionality of the new lighting systems further by automatically controlling the operation of the systems based on space occupancy. Occupancy sensors continuously scan the space for motion and heat and shut off light fixtures when the space is determined to be unoccupied for a certain period of time (i.e. 15 minutes).

Existing Conditions

When implementing a comprehensive lighting upgrade (as described in FIM #1 above), the New York State Energy Code requires that the entire lighting system also comply with code requirements for automatic lighting controls. In the Village of Lancaster Municipal Building and DPW Facility, this involves adding lighting occupancy sensors to the required spaces, including offices, conference rooms and restrooms.

Recommendations

Danforth proposes to install occupancy sensors throughout the Municipal Building and DPW Facility as required by code in the spaces designated in the lighting survey in Section 5 of this report. Adding occupancy sensors to accompany the new LED lights in these facilities will result in a responsive, highly efficient lighting system that provides significant energy savings to the Village of Lancaster.

Scope of Work

Danforth will provide all labor and materials for the following lighting sensor upgrades in the Village. The quantity of lighting sensor upgrades recommended for each building is shown below.

Municipal Building – 30 total occupancy sensors

DPW – 16 total occupancy sensors

Detailed lighting surveys can be found in Section 5 of this report.

Savings Analysis

Lighting energy savings is derived from a reduction in electric usage. Baseline utility rates are used for calculating energy cost savings.

Electric Usage Savings are calculated by multiplying the predicted kWh reduction by the base year unit energy rate for kWh for the facility.

The complete methodology for determining energy savings for these measures is shown in the lighting surveys in Section 5 of this report

Facility Improvement Measure Summary

FIMs #3 & 13 - Lighting Control Retrofits					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 4,917	$ 34	$ 10	$ 0	111.9
DPW	$ 3,121	$ 47	$ 6	$ 0	58.2
TOTAL	$ 8,038	$ 81	$ 16	$ 0	82.4

FIMs #4, 10 & 13 – Building Envelope Improvements

Concept

Air leakage is defined as the uncontrolled migration of conditioned air through the building envelope caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems. It has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings.

Beyond the potential for energy savings, uncontrolled air leakage can affect thermal comfort of occupants, air quality through ingress of contaminants from outside and the imbalance of mechanical systems, and the structural integrity of the building envelope through moisture migration. Control of air leakage involves the sealing of gaps, cracks and holes, using appropriate materials and systems, to create, if possible, a continuous plane of air-tightness to completely encompass the building envelope. Part of this process also incorporates the need to "decouple" floor - to - floor, and to "compartmentalize" components of the building in order to equalize pressure differences.

Existing Conditions

The buildings were inspected visually to identify location and severity of air leakage paths. Air leakage paths are detailed in the scope of work below.

The air infiltration or ex-filtration flows in the building can be estimated by evaluating various leakage paths in the building. The leakage distribution in buildings is a function of the style of construction which, in turn is a response to the climatic conditions, the prevailing architectural fashion and the building code requirements at the time of construction. The leakage distribution, being largely accidental, differs substantially in each building.

A large number of doors have either poor or nonexistent weather-stripping. There are also many areas where the roof and walls meet on the perimeter of the buildings that have air leakage. Some of the buildings have missing or inadequate insulation. These conditions cause comfort complaints as well as higher energy usage.

Recommendations

Danforth recommends repairs and upgrades to the building envelope to reduce infiltration/exfiltration and improve comfort levels, as well as reduce natural gas or fuel oil usage. Heat flows from a warmer to a cooler space. Insulation provides resistance to heat flow, thereby reducing the amount of energy needed to keep a building warm in the winter and cool in the summer. Adding insulation strategically will improve the efficiency of the

building. However, it is only effective if the building is properly sealed. Sealing cracks and leaks to prevent air flow is crucial for effective building envelope insulation. Leaks can generally be sealed with caulk, spray foam, or weather stripping.

Scope of Work

Danforth will provide all labor and materials for each of the following items. All weather-stripping is to be made of aluminum mill finish carrier with a black gasket, unless otherwise specified.

Municipal Building

7	Single commercial doors to be weather-stripped (6 dark bronze anodized)
1	Single commercial roof access door to be weather-stripped
1	Single commercial roof access hose tower door to be weather-stripped
1	Single commercial door to be weather-stripped, sweep only
1	Double commercial door to be weather-stripped (dark bronze anodized)
1	Double commercial door to be weather-stripped, sweeps and astragals only
1	Roof top ventilator to be opened, damper lubricated and perimeter sealed, 8 linear feet
28'	Wall joint/pipe/conduit penetrations in boiler room interior wall to be fire blocked

Northend Fire Hall

3	Single commercial doors to be weather-stripped (1 dark bronze anodized)
1	Double commercial door to be weather-stripped
2	Overhead garage doors to be weather-stripped, 96 linear feet
20	Truss penetrations to be sealed, main entry hall and gathering room
3	Block vents in garage bay to have insulated doors installed at interior

DPW

Main

4 Single commercial doors to be weather-stripped

1 Double commercial doors to be weather-stripped

1 Double commercial roof access door to be weather-stripped

4 Overhead garage doors to be weather-stripped, 248 linear feet

4 Roof top ventilators to be opened, dampers lubricated and perimeters sealed, 32 linear feet

Old DPW

1 Single commercial door to be weather-stripped

3 Overhead garage doors to be weather-stripped, 96 linear feet

1 Wall penetration to be covered and sealed

Storage Building

1 Single commercial door to be weather-stripped

2 Overhead garage doors to be weather-stripped, 128 linear feet

Savings Analysis

Energy savings associated with building air sealing are based on reducing the air flow rate of infiltration air by sealing gaps and cracks in each facility's building envelope. The reduction in infiltration rate is proportional to the total leakage area to be sealed. Heat loss savings can be calculated by applying the infiltration rate savings to the average annual heating degree days for this location.

Refer to Section 6 for the detailed savings calculations associated with this measure.

Facility Improvement Measure Summary

FIMs #4, 10 & 13 – Building Envelope Improvements					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 4,704	$ 237	$ 0	$ 0	19.9
Northend Fire Hall	$ 5,801	$ 203	$ 0	$ 0	28.5
DPW	$ 19,699	$ 1,161	$ 40	$ 0	16.4
TOTAL	$ 30,205	$ 1,601	$ 40	$ 0	18.4

FIMs #5 & 15 – Boiler Replacements

Concept

Older water tube boilers are designed to obtain heating efficiencies in the range of 75 % to 82 %. Upper efficiency limitations are a result of maintaining hot operating conditions within the boilers to protect them from both thermal shock and corrosive liquid condensate in the flue gasses. Boilers that are not designed to accept low return water temperatures or operate with condensate in the flue system must be operated at higher temperatures, even when heating loads in the facility are low.

Modern condensing heating systems can achieve efficiencies as high as 93%, converting nearly all the fuel to useful heat. Energy efficiency upgrades and a new high-efficiency heating system can often cut the fuel usage and pollution output of a facility in half. In addition there can be appreciable energy and cost savings by converting older boilers to condensing boilers.

Existing Conditions

Existing Municipal Building Hot Water Boiler

The existing Peerless boiler is beyond its useful life. It's a natural gas fired, atmospheric sectional boiler with an estimated efficiency of 80% or less. The circulation pumps and motors are of standard efficiency and appear to have been replaced since original installation.

Existing DPW Building Hot Water Boiler

The existing Bryan boiler is original to the building with an efficiency of 77%. The boiler provides heating water for fin radiation and some terminal units within the building. The circulation pumps are of standard efficiency.

Recommendations

Danforth proposes to remove the existing boilers in the Municipal Building and the DPW Facility and replace them with condensing hot water boilers. These new boilers will be significantly more efficient than the existing units and provide substantial fuel reductions in both facilities while continuing to effectively maintain comfort conditions.

Scope of Work

Danforth will provide all labor, equipment and materials associated with the following scope in each facility:

Municipal Building

- Demolition of existing boiler system
- Installation of one (1) new condensing boiler sized for building load
- Installation of one (1) new boiler pump
- Installation of venting

- Provide power wiring, insulation and controls

DPW

- Demolition of existing boiler system
- Installation of one (1) new condensing boiler sized for building load
- Installation of one (1) new boiler pump
- Installation of venting
- Provide power wiring, insulation and controls
- Install 12' of finned tube radiation in front office
- Install one (1) hot water unit heater in the crew room

Equipment cutsheets and supporting documentation for this measure can be found in Section 7 of this report.

Savings Analysis

The existing boilers are non-condensing meaning that the flue gasses are kept elevated to prevent moisture in the gas from condensing out of the flow stream and dripping back down into the flue system. For these types of boilers, hot water supply temperatures must be kept elevated at all times to prevent condensation. The escape of hot flue gasses results in combustion efficiencies that are limited to approximately 85% under best operating conditions. Combine this with boiler shell and stand-by losses and overall boiler efficiency can be as good as 80%. High-efficiency condensing boilers can reach efficiencies as high as 96% under the right conditions.

Detailed energy savings calculations for this measure can be found in Section 6 of this report.

Facility Improvement Measure Summary

FIMs #5 & 15 – Boiler Replacements					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 161,140	$ 3,374	$ 325	$ 4,000	42.5
DPW	$ 169,112	$ 2,288	$ 341	$ 3,000	63.2
TOTAL	$ 330,252	$ 5,661	$ 666	$ 7,000	51.1

FIMs #6 & 14 – Rooftop Unit Replacements

Concept

Although their annual fuel utilization efficiencies (rated at design capacity) are similar to those of mid-efficiency units, high efficiency units offer higher seasonal efficiencies due to their enhanced part-load performance. Modulating units regulate combustion air and natural gas flows according to heating demand. By regulating the flow, the units may operate for longer periods, thus significantly reducing cycling losses and minimizing operating costs. These systems also provide better temperature control and are capable of maintaining high comfort levels in multiple zones.

Existing Conditions

Existing Municipal Building Rooftop Units

The three existing packaged rooftop units are of standard efficiency and they appear to be beyond their useful life.

Existing DPW Rooftop Units

The two existing rooftop units at the DPW Facility are inefficient by today's standards and have reached the end of their useful lives.

Recommendations

Danforth proposes the installation of new high efficiency package rooftop units which meet the NYS energy code and utilize economizer cooling.

Scope of Work

Danforth will provide all labor, equipment and materials associated with the following scope in each facility:

Municipal Building

- Removal of four (4) existing rooftop units
- Installation of one (1) 7 ½ ton rooftop unit with curb adapter
- Installation of two (2) 4 ton rooftop units with curb adapters
- Installation of one (1) 3 ton rooftop unit with curb adapter
- Provide power wiring and controls

DPW

- Removal of four (2) existing rooftop units
- Installation of one (1) 4 ton rooftop unit with curb adapter
- Installation of one (1) 3 ton rooftop unit with curb adapter
- Provide power wiring and controls

Savings Analysis

Energy savings generated by this measure are based on installing new rooftop units with more efficient compressors, meaning that the new units will consume less electricity (resulting in electric usage and demand savings) to meet the same building cooling loads.

Detailed energy savings calculations for this measure can be found in Section 6 of this report.

Facility Improvement Measure Summary

FIMs #6 & 14 – Rooftop Unit Replacements					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 113,356	$ 474	$ 229	$ 750	160.3
DPW	$ 56,751	$ 193	$ 114	$ 0	184.8
TOTAL	$ 170,106	$ 666	$ 343	$ 750	167.8

FIM #7– Install Building Management System (Municipal Building)

Concept

During the seventies and through the nineties temperature control was accomplished with either pneumatic systems or simple standalone thermostats in most commercial buildings. Now Direct Digital Controls (DDC) are the system of choice. They are more accurate at temperature measurements and control than older pneumatic systems. Using DDC, it is possible to develop historical records on the operating characteristics of a building to identify trends which can lead to better performance. This computer based control system can be extended to implement a number of advanced control sequences that will reduce energy use by making the building systems smarter. These systems take several different building factors into consideration to determine the capacity at which the equipment is working most efficiently.

DDC controls can be applied to such equipment as: boilers and hot water systems, controllers, air handing units (Constant volume, variable volume), pumps, lighting systems and chilled water systems. Tying these pieces of equipment into a DDC control system can greatly reduce the amount of energy that is consumed both during active and dormant settings. Additionally, building alarms and security systems can benefit from these controls.

Existing Conditions

Existing Municipal Building Thermostat

The Municipal Building's HVAC control system is a combination of pneumatic and stand-alone thermostats. Pneumatic controls are outdated as a means to control HVAC

equipment. Non-programmable thermostats can be left on, allowing equipment to run during unoccupied times.

Scope of Work

Danforth proposes to provide interconnection and reporting of the Direct Digital Control (DDC) system complete with all material, engineering, software, programming, system start-up and owner training. The software will utilize the Village's existing servers and workstations. Connecting this new front end system to the DDC controls on the building's new boiler and rooftop units give building operators better control over building systems, ensure equipment operating and temperature schedules match the occupancy schedule of the facility and improve the overall building efficiency.

Savings Analysis

This measure will significantly improve the operation of the Municipal Building's HVAC systems and improve comfort conditions throughout the building. The control system will be scheduled to maintain comfortable conditions during the daytime when the building is occupied and setback the temperature setpoints to 58°F during unoccupied periods.

Refer to Section 6 for the detailed savings calculations associated with this measure.

Facility Improvement Measure Summary

FIM #7 – Install Building Management System										
Building	Implementation Price		Energy Savings		Associated Savings		Estimated Utility Incentive		Net Payback	
Municipal Building	$	15,390	$	243	$	31	$	0	56.1	
TOTAL	$	15,390	$	243	$	31	$	0	56.1	

FIMs #8 – Replace PTACs with Rooftop Unit

Concept

Although their annual fuel utilization efficiencies (rated at design capacity) are similar to those of mid-efficiency units, high efficiency units offer higher seasonal efficiencies due to their enhanced part-load performance. Modulating units regulate combustion air and natural gas flows according to heating demand. By regulating the flow, the units may operate for longer periods, thus significantly reducing cycling losses and minimizing operating costs. These systems also provide better temperature control and are capable of maintaining high comfort levels in multiple zones.

Existing Conditions

Existing Municipal Building PTAC Unit (typical)

There are four offices on the second floor utilizing older, inefficient self contained package units that are beyond their useful life.

Recommendations

Danforth proposes to remove the six existing PTAC units on the second floor of the Municipal building and install a gas-fired rooftop unit with DX cooling to provide heating, cooling and ventilation air to these spaces. This measure will provide significant savings to the facility based on the fact that using natural gas for heating is more cost-effective than using electricity, and the new rooftop unit compressor will operate more efficiently than the existing PTAC unit compressors during the cooling season.

Scope of Work

Danforth will provide all labor, equipment and materials associated with the following scope:

- Removal of six (6) packaged terminal air conditioning (PTAC) units in the 2nd floor offices
- Installation of one (1) new PTAC unit in the District Attorney's office
- Installation of one (1) gas-fired 4 ton rooftop unit with new roof curb
- Provide power wiring and controls

Savings Analysis

Energy savings generated by this measure are based on installing a new rooftop unit with more efficient compressor than that of the existing PTAC units, meaning that the new units will consume less electricity (resulting in electric usage and demand savings) to meet the same building cooling loads. The new gas-fired unit will also provide heating more cost-effectively than the existing equipment.

Detailed energy savings calculations for this measure can be found in Section 6 of this report.

Facility Improvement Measure Summary

FIM #8 – Replace PTACs with Rooftop Unit					
Building	Implementation Price	Energy Savings	Associated Savings	Estimated Utility Incentive	Net Payback
Municipal Building	$ 86,114	$ 1,777	$ 174	$ 0	44.1
TOTAL	$ 86,114	$ 1,777	$ 174	$ 0	44.1

5.0 LIGHTING SURVEYS

6.0 SAVINGS CALCULATIONS

FIM #2 - INTERIOR AND EXTERIOR LIGHTING UPGRADES

VILLAGE OF LANCASTER EPC Project

HEATING PENALTY AND COOLING BENEFIT FROM RETROFITTING EXISTING LIGHTING

INPUTS

Assumptions					
Average Heating System Efficiency:	80%		Heating Season	Weeks per Year:	32.6 weeks
Average Cooling System Efficiency:	1.0	kW/ton	Duration	% of Year:	62.7%
Building / Project Type:	Small Office		Cooling Season	Weeks per Year:	14.0 weeks
Lighting Contribution to Heating:	0.28		Duration	% of Year:	26.9%
Lighting Contribution to Cooling:	-0.48				

SAVINGS SUMMARY

Building	Lighting Savings		Heating Penalty			Cooling Benefit	Cost Savings			
	Monthly Demand Savings	Annual Energy Savings	Additional Natural Gas Usage	Additional Fuel Oil Usage	Additional Propane Usage	Annual Energy Savings	Lighting	Heating	Cooling	Total Annual Cost Savings
	kW	*kWh*	*therm*	*gal*	*gal*	*kWh*				
Municipal Bldg	23.1	40,766	305	-	-	1,498	$ 30,000	$ (305)	$ 120	**$ 29,815**
Northend Fire Hall	4.0	3,518	26	-	-	129	$ -	$ -	$ -	$ -
DPW	11.0	28,392	213	-	-	1,044	$ -	$ -	$ -	$ -
Building #4	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #5	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #6	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #7	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #8	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #9	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #10	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #11	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #12	-	-	-	-	-	-	$ -	$ -	$ -	$ -
Building #13	-	-	-	-	-	-	$ -	$ -	$ -	$ -
TOTAL	**38.1**	**72,676**	**544**	-	-	**2,671**	**$ 30,000**	**$ (305)**	**$ 120**	**$ 29,815**

ASSUMPTIONS

- Ref #1 - "Interactions Between Lighting and Space Conditioning Energy Use in U.S. Commercial Buildings"; Publication LBNL-39793; Lawrence Berkley National Laboratory
- Ref #2 - "Lighting's Impact on Heating, Ventilation and Air Conditioning"; Lighting Design Lab; Sponsored by Northwest Energy Efficiency Council
- Heating system interaction with lighting power reduction is calculated using the following formula (ref #2):

  Fraction to Heat Load = A x B x kwh Savings / Heating System Efficiency

  where A = fraction of weeks per year heating = 32.6/52 = .627

  B = lighting contribution to heat = .29 for small office buildings (ref #1)
- Cooling system interaction with lighting power reduction is calculated using the following formula (ref #2):

  Fraction to Cooling Load = A x B x kwh Savings / Cooling System Efficiency

  where A = fraction of weeks per year cooling = 14/52 = .270

  B = lighting contribution to cooling = -.46 for small office buildings (ref #1)

FIM #4 - BUILDING ENVELOPE IMPROVEMENTS

Village of Lancaster EPC

Project:	Village of Lancaster
Building:	Municipal Building
Date:	11/30/2017

Heating System Efficiency:	90%
Average Fuel Cost ($/unit):	$0.60
Correction Factor:	100%

Area

Work to be completed	No. of Units	Perimeter (ft)	Crackage (in)	Conversion to feet		Product
Single door sweeps	10	3	1/8	1/12	=	0.31
Single door perimeters	9	17	1/16	1/12	=	0.80
Double door sweeps & astragals	2	20	1/8	1/12	=	0.42
Double door perimeters	1	20	1/16	1/12	=	0.10
Roof top ventilators	1	8	1/6	1/12	=	0.11
Joint fire blocking	1	28	-	-	=	0.00
				Total =		1.74 ft^2

Occupied Flow Rate

$Q = A_L\sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (without roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
234.8	50%	0.0449	72	32.18	0.0101	12.6	216.5

Occupied Infiltration Savings

Specific Heat of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Occupied (%/week)	Heating Season Bin Hours (Occupied)	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	216.5	39.8	29.76%	4354	100000	90%	134.0

Unoccupied Flow Rate

$Q = A_L\sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (with roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
250.8	50%	0.0449	67	32.0	0.0101	12.6	223.7

Unoccupied Infiltration Savings

Specific Hear of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Unoccupied (%/week)	Heating Season Bin Hours (Unoccupied)	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	223.7	35.0	70.24%	4307	100000	90%	284.1

Totals

Units of Fuel per Year (units/yr.)	Fuel Heating Value Btu's/unit	Units/MMBtu	Total MMBtu Savings (MMBtu/yr)
418.1	100000	10	41.8

418 therms

Total Amount of Fuel Savings (units/yr)	Fuel Cost ($/unit)	Total Cost Savings ($/yr)
418.1	$0.60	$ 249.44

FIM #10 - BUILDING ENVELOPE IMPROVEMENTS

Project: Village of Lancaster
Building: Northend Fire Hall
Date: 11/30/2017

Heating System Efficiency:	90%
Average Fuel Cost ($/unit):	$0.70
Correction Factor:	100%

Area

Work to be completed	No. of Units	Perimeter (ft)	Crackage (in)	Conversion to feet		Product
Single door sweeps	3	3	1/8	1/12	=	0.09
Single door perimeters	3	17	1/16	1/12	=	0.27
Double door sweeps & astragals	1	20	1/8	1/12	=	0.21
Double door perimeters	1	20	1/16	1/12	=	0.10
Garage doors	2	96	1/16	1/12	=	0.50
Truss penetrations	20	0.5	1/2	1/12	=	0.42
Block vents	3	1.5	1/2	1/12	=	0.19
					Total =	1.78 ft^2

Occupied Flow Rate

$Q = A_L \sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (without roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
255.8	50%	0.015	72	32.2	0.0065	12.6	163.6

Occupied Infiltration Savings

Specific Heat of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Occupied (%/week)	Heating Season Bin Hours (Occupied)	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	163.6	39.8	29.8%	4354	100000	90%	101.3

Unoccupied Flow Rate

$Q = A_L \sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (with roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
255.8	50%	0.015	67.0	32.0	0.0065	12.6	159.9

Unoccupied Infiltration Savings

Specific Hear of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Unoccupied (%/week)	Heating Season Bin Hours (Unoccupied)	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	159.9	35.0	70.2%	4307	100000	90%	203.0

Totals

Units of Fuel per Year (units/yr.)	Fuel Heating Value Btu's/unit	Units/MMBtu	Total MMBtu Savings (MMBtu/yr)
304.3	100000	10	30.4

Total Amount of Fuel Savings (units/yr)	Fuel Cost ($/unit)	Total Cost Savings ($/yr)
304.3	$0.70	$ 214.15

FIM #13 - BUILDING ENVELOPE IMPROVEMENTS

Project: Village of Lancaster
Building: Department of Public Works
Date: 11/30/2017

Heating System Efficiency:	90%
Average Fuel Cost ($/unit):	$0.60
Correction Factor:	100%

Area

Work to be completed	No. of Units	Perimeter (ft)	Crackage (in)	Conversion to feet		Product
Single door sweeps	6	3	1/8	1/12	=	0.19
Single door perimeters	6	17	1/16	1/12	=	0.53
Double door sweeps & astragals	2	20	1/8	1/12	=	0.42
Double door perimeters	2	20	1/16	1/12	=	0.21
Garage doors	9	472	3/16	1/12	=	7.38
Roof top ventilators	4	32	1/6	1/12	=	0.44
Wall penetration	1	1	6	1/12	=	0.50
					Total =	9.66 ft^2

Occupied Flow Rate

$Q = A_L \sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (without roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
1327.5	50%	0.0299	72	32.2	0.0086	12.6	1063.0

Occupied Infiltration Savings

Specific Heat of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Occupied (%/week)	Heating Season Bin Hours	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	1063.0	39.8	29.8%	4354	100000	90%	658.1

Unoccupied Flow Rate

$Q = A_L \sqrt{(C_s \times \Delta T + C_w \times U^2)}$ Ref: ASHRAE 2009 Fundamentals 16.23 (43)

Effective Air Leakage Area (in^2) (with roof fan leakage area) A_L	Windward Diversity (%)	Stack Coefficient ($cfm^2/(in^4 \cdot °F)$) C_s	Indoor Air Temperature (°F)	Average Outdoor Air Temperature (°F)	Wind Coefficient ($cfm^2/(in^4 \cdot mph^2)$) C_w	Average Wind Speed (mph) U	Flow Rate (cfm) Q_{occ}
1391.5	50%	0.0299	67.0	32.0	0.0086	12.64	1082.3

Unoccupied Infiltration Savings

Specific Hear of Air by Density of Inlet Air Constant Rho ρ	Flow Rate (cfm) Q_{occ}	Temperature Differential (ΔT)	Percent Unoccupied (%/week)	Heating Season Bin Hours	Fuel Heating Value Btu's/unit	Heating System Efficiency (%)	Units of Fuel per Year (units/yr.)
1.08	1082.3	35.0	70.24%	4307	100000	90%	1374.4

Totals

Units of Fuel per Year (units/yr.)	Fuel Heating Value Btu's/unit	Units/MMBtu	Total MMBtu Savings (MMBtu/yr)
2032.5	100000	10	203.3

2033 therms

Total Amount of Fuel Savings (units/yr)	Fuel Cost ($/unit)	Total Cost Savings ($/yr)
2032.5	$0.60	$ 1,222.06

Municipal Bldg - Hot Water Boiler Upgrades
Village of Lancaster EPC

INPUTS

Baseline			
Baseline Total Annual Consump	16,649	therm	
DHW % of Total:	15%		*Bradford White*
Gas RTUs % of Total:	0%		*No Direct fired gas unit heaters found in the Fireengine garage of Muni Bldg*
DHW Baseline Annual Consump	2,497	therm	
Baseline Boiler Annual Consum	14,152	therm	

Utility Costs			
Natural Gas Rate:	$ 0.60	per therm	

Equipment		
Existing Boiler Thermal Efficienc	76.0%	
Proposed Boiler Thermal Efficie	92.2%	*RBI Flexcore Boiler Cutsheet; AHRI Peak Boiler Efficiency: 96.8% @ 80F/60% load*

Building Area	21,282	sqft	
	139	Btu/hr/sqft	*usually 40 to 50 Btu/hr/sqft*

Municipal Bldg - Hot Water Boiler Upgrades
Village of Lancaster EPC

	Existing		Proposed	
Model#			RBI CK 1500	
Existing Boiler Input:	2,310,000	Btu/hr		
	2,310	kBtu/hr	1,999	kBtu/hr
Existing Boiler Output	1,848,000	Btu/hr		
	1,848	kBtu/hr	1,901	kBtu/hr
% of Boiler Fuel Use	85%		100%	
	1,415	MMBtu/yr	895	MMBtu/yr
Existing Combustion Efficiency	76%		92.2%	
Actual Boiler Capacity	1,756	kBtu/hr	1,842	kBtu/hr
Jacket Losses	1%		0.8%	
Boiler is hot when OAT<	60	°F	60.0	°F
Hours/ Yr. Unit is Hot	5,637	hrs.	5,637	hrs.
Off-Cycle Flue Losses	0.5%		0.3%	
Off-Cycle Hours/Year	4,498	hrs.	4,498	hrs.
Jacket Losses	99	MMBtu/yr	83	MMBtu/yr
Off-Cycle Flue Losses	39	MMBtu/yr	25	MMBtu/yr
Useful Heat Output	937	MMBtu/yr	895	MMBtu/yr
Proposed Boiler Input			1,088	MMBtu/yr

Adjustments for Other Measures:

Fuel Savings

42	MMBtu/yr	Building Air Sealing
42	MMBtu/yr	
937	MMBtu Useful Heat Output (present)	
895	MMBTU Req'd from New Boilers	

Jacket Losses

0.50% for low water volume boilers
1.00% for scotch marine type fire tube boilers
1.80% for cast iron sectional boilers (varies considerably)
2.00% for steel firebox boilers
3.00% for brick-set firebox boilers

Off-Cycle Flue Losses

0.50% for power burners and low water volume boilers
0.90% for power burners on scotch marine type fire tube boilers
3.00% for atmospheric burners

	Annual Fuel Consumption (MMBtu)	(Therms)	Annual Cost
Present:	1,415	14,152	$ 8,491
- Fuel Saved by Other FIMs	42	418	$ 251
Proposed:	1,088	10,885	$ 6,531
Annual Savings:	**285**	**2,849**	**$ 1,710**

Off-Cycle Flue Losses = Boiler kBtuh Output x 1000 x % Off-Cycle Flue Losses x Hrs Off-Cycle per Year / 1,000,000
Jacket Losses = Boiler kBtuh Output x 1000 x % Jacket Losses x Hrs Hot per Year / 1,000,000
Useful Heat Output = (Htg Fuel Use x BTU per Unit x Present Efficiency / 1,000,000) - Off Cycle Losses - Jacket Losses
Proposed Annual Fuel Consumption = (Proposed Off-Cycle & Jacket Losses + Useful Heat Output) / Proposed Efficiency x 1,000,000 / BTU per Unit

Municipal Bldg - Hot Water Boiler Upgrades
Village of Lancaster EPC

Weather Data			Hot Water		Efficiency	
ΔT °F	Mid-pts °F	Total Hours	HWST °F	HWRT °F	Existing Boiler Efficiency	Proposed Condensing Boiler Efficiency
95 to 100	97.5	1			-	-
90 to 95	92.5	10			-	-
85 to 90	87.5	66			-	-
80 to 85	82.5	309			-	-
75 to 80	77.5	515			-	-
70 to 75	72.5	469			-	-
65 to 70	67.5	832			-	-
60 to 65	62.5	921	120	100	76%	94.5%
55 to 60	57.5	702	120	100	76%	94.5%
50 to 55	52.5	568	120	100	76%	94.5%
45 to 50	47.5	455	120	100	76%	94.5%
40 to 45	42.5	647	127	107	76%	93.0%
35 to 40	37.5	992	133	113	76%	91.5%
30 to 35	32.5	659	140	120	76%	90.8%
25 to 30	27.5	440	147	127	76%	90.0%
20 to 25	22.5	405	153	133	76%	89.5%
15 to 20	17.5	382	160	140	76%	88.5%
10 to 15	12.5	228	167	147	76%	88.0%
5 to 10	7.5	119	173	153	76%	87.5%
0 to 5	2.5	27	180	160	76%	87.5%
-5 to 0	-2.5	10	180	160	76%	87.5%
-10 to -5	-7.5	3	180	160	76%	87.5%
-15 to -10	-12.5	0	180	160	76%	87.5%
TOTAL		8,760				
Weighted Avg Existing Boiler Efficiency			76%			
Weighted Avg Proposed Boiler Efficiency			92.2%			

Village of Lancaster
Municipal Bldg
Repalce Existing Hot Water Pumps with High Efficiency HW Pumps

Background

Two constant flow inline circulating pumps provide heating hot water to the building. The pumps are in fair condition, however it was noted during our walkthrough that they undergo some type of repair or replacement yearly. Any modification or replacement of the building boiler plant would most likely require modifications or replacement of existing piping and pumps within the boiler room.
This spreadsheet calculates the savings due to following:
- Conversion from Constant volume HW system to Variable volume HW system and converting 3 way to 2 way valves.
- Converting PSC to ECM Motors on HW Circulator Pumps

Energy Savings Calculations

Building	Equipment	Type	Qty	hp	Efficiency	Load Factor	kW	Hours	kWh	
WTP	HW Pump (Inline)	Primary	2	1.5	80%	63%	1.8	3180	5,604	M-F; 7AM TO 7PM
WTP	HW Pump (Inline)	Secondary	0	0	80%	63%	0	3180	-	

HW Pumping Energy

			Constant Speed			Variable Speed			Savings	
% Load	Percent of Op. Hours	Op. Hours	% Power	Total kW	Annual kWh	% Power	Total kW	Annual kWh	Total kW	Total kWh
100%	1%	32	100%	1.8	57	100%	1.1	36	0.68	21
75%	42%	1335	100%	1.8	2,404	46%	0.5	691	1.28	1,713
50%	45%	1431	100%	1.8	2,575	20%	0.2	322	1.58	2,253
25%	12%	382	100%	1.8	687	20%	0.2	86	1.58	601
		3180			5723		1.1	1,134		4,589

Energy Savings Summary:

Power Savings	0.68	kW	
Energy Savings	4589	kWh	4589

Notes:

(1) Motor load data is used if available. Otherwise the default is taken from the following list.

Air Comp	0.8	Ref: PG&E Resource Binder
Exhaust Fan	0.63	Ref: PG&E Resource Binder
Fan	0.63	Ref: PG&E Resource Binder
Industrial Fan	0.78	Ref: PG&E Resource Binder
Misc	0.75	JWD assumption
Pump	0.58	Ref: PG&E Resource Binder

Variable Speed Part Load Energy Modifier
The following information is taken from the DOE-2.1 Compliance Supplement.

% Flow	Constant Volume	VFD	Inlet Vanes BI/AF	Vane Axial Variable Pitch	Outlet Dampers BI/AF
a	1	0.2197619	0.584345	0.2120476	0.2271429
b	0	-0.874784	-0.57917	-0.569286	1.1789286
c	0	1.6525974	0.970238	1.3452381	-0.410714
d	0	0	0	0	0

AF - airfoil
BI - backward inclined
FC - forward curved
VFD - variable frequency drive
x = percent motor speed (proportional to percent flow)
y = part load energy modifier
kW (x) = kW (full speed) * y(x)
$y(x) = a + bx + cx^2 + dx^3$

Fan Flow Control Efficiencies

No Control	100%	Inlet vane, discharge damper
Inlet Vanes	92%	and VFD efficiencies are based
Fan Discharge Dampers	90%	on information from EPRI
Variable Frequency Drive	98%	publications.
Variable Pitch, Vane Axial	100%	

Motor Efficiencies

Typical PSC fractional hp motor	50%
Typical EC fractional hp motor	80%
National Grid estimate	3240
HW VFD Exponent	2.7

(2) Retrofit Analysis: Nameplate efficiency is used if available. Otherwise the default is taken from the New York Department of Public Service "New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs," October 15, 2010

(3) The baseline efficiency of a standard permanent split-capacitor (PSC) motor is estimated to be 50%.
The measure efficiency of a fractional horsepower EC motor is estimated to be 80%.
High efficiency circulators may include better impeller design that will increasekWh savings, but may have a negative impact on gas consumption. These effectsare ignored.
Annual heating hours are based on a continuously running circulator. Savingswill be less if the circulator cycles on and off with a call for heat.

(4) Calculated as: kW = Qty x Hp x 0.746 kW/hp x Variable Speed Part Load Energy Modifier x Fan Flow Control Efficiencies (Constant/Variable) x Load Factor / Baseline Efficiency

(5) Calculated as: kWh/yr = Baseline Load kW x Annual Operating Hours

FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Input | *Model Results*

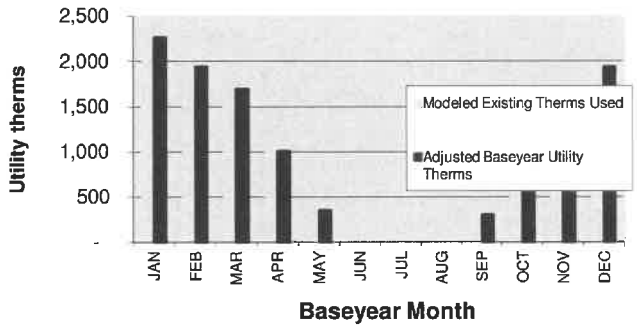
RESULTS SUMMARY (at a glance)

Annual Fuel Calibration	0.0%
Annual Fuel Consumption Basline, therms	11,724
Annual Fuel Consumption Post-Installation, therms	9,218
Annual Fuel Consumption Savings, therms	2,506.3
Percent Savings, overall	21.4%
Percent Savings, by Schedule:	
Schedule 1: Mon-Fri, 5 AM to 7 AM, Sep-May	0.9%
Schedule 2: Mon-Fri, 8 AM to 4 PM, Sep-May	0.0%
Schedule 3: Mon-Fri, 5 PM to 8 PM, Sep-May	1.7%
Schedule 4:Mon-Fri, 9 PM to 5 AM, Sep-May	9.3%
Schedule 5: Mon-Fri, 6 AM to 3 PM, Jun-Aug	0.0%
Schedule 6: Mon-Fri, 4 PM to 5 AM, Jun-Aug	0.0%
Schedule 7: Sat-Sun, 1 AM to 12 AM, Jan-Dec	9.5%
Annual Cost Savings	$ 3,614

PREDICTED SAVINGS

Month	*Boilers*	*Controls*
JAN	$ -	$ 510
FEB	$ -	$ 450
MAR	$ -	$ 461
APR	$ -	$ 437
MAY	$ -	$ 180
JUN	$ -	$ -
JUL	$ -	$ -
AUG	$ -	$ -
SEP	$ -	$ 218
OCT	$ -	$ 410
NOV	$ -	$ 439
DEC	$ -	$ 510
OVERALL	$ -	$ 3,614
therm	-	2,506.3

CALIBRATION: Model vs Baseyear Therm Usage



FUEL CALIBRATION (therms)

Month	*Modeled*	*Baseyear*	*delta %*
JAN	2264	2266	-0.1%
FEB	1947	1947	0.0%
MAR	1697	1697	0.0%
APR	1008	1008	0.0%
MAY	354	354	-0.1%
JUN	0	0	-
JUL	0	0	-
AUG	0	0	-
SEP	311	312	-0.1%
OCT	876	876	0.0%
NOV	1330	1330	0.0%
DEC	1937	1937	0.0%
OVERALL	11724	11728	0.0%

SAVINGS SUMMARY BY MONTH (therms)

Month	*Modeled therms*	*Baseyear Space Heat*	*Boiler Cntrl Savings*	*Controls Savings*	*Predicted Space Heat*	*Total Savings*	*% Savings*
JAN	2,264	2,266	0	354	1,912	354	15.6%
FEB	1,947	1,947	0	312	1635	312	16.0%
MAR	1,697	1,697	0	320	1377	320	18.8%
APR	1,008	1,008	0	303	705	303	30.1%
MAY	354	354	0	125	230	125	35.2%
JUN	0	-	0	0	0	0	0.0%
JUL	0	-	0	0	0	0	
AUG	0	-	0	0	0	0	
SEP	311	312	0	151	160	151	48.6%
OCT	876	876	0	284	592	284	32.4%
NOV	1,330	1,330	0	304	1026	304	22.9%
DEC	1,937	1,937	0	354	1584	354	18.3%
OVERALL	11,724	11,728	0	2,506	9,221	2,506	21.4%

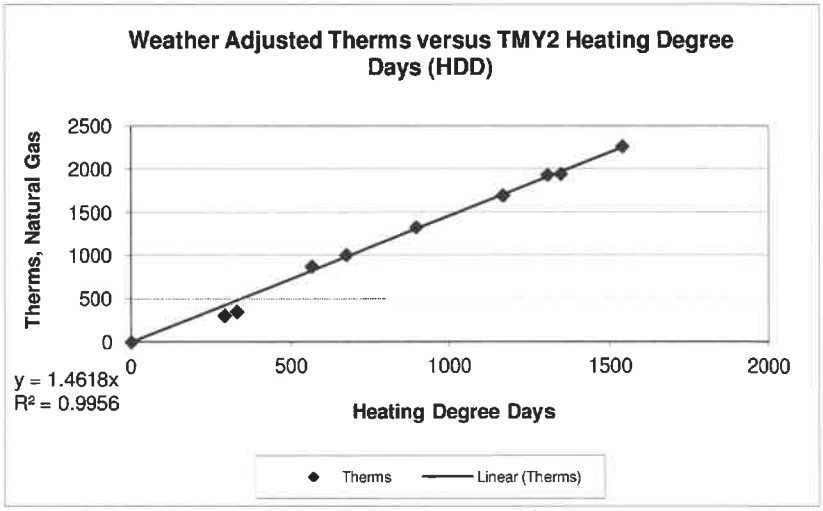
FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Output — *Weather Adjustments and Checks*

HEATING DEGREE DAY COMPARISON - BASEYEAR vs TMY DATA vs 30 YEAR AVERAGE

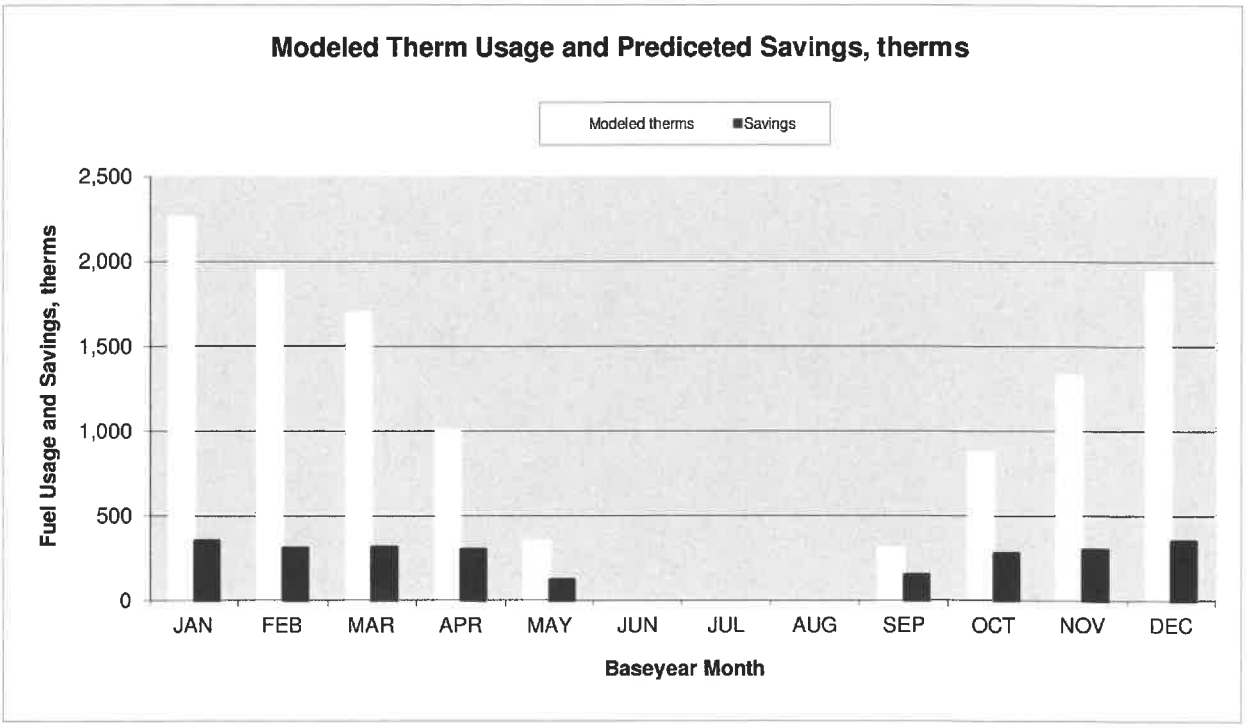
Month	*BaseYear HDD*	*TMY2 HDD*	*% diff*	*30 Yr Avg HDD*	*% diff*
JAN	1573	1541	-2.1%	1559	-0.9%
FEB	1490	1347	-10.6%	1332	-10.6%
MAR	1257	1167	-7.7%	1122	-10.7%
APR	642	676	5.0%	655	2.0%
MAY	240	331	27.5%	280	16.7%
JUN	0	119	N/A	0	N/A
JUL	0	72	N/A	0	N/A
AUG	0	77	N/A	0	N/A
SEP	211	292	27.6%	209	-0.9%
OCT	425	565	24.8%	563	32.5%
NOV	876	897	2.3%	886	1.1%
DEC	1283	1307	1.8%	1343	4.7%
OVERALL	7997	8389	4.7%	7949	-0.6%

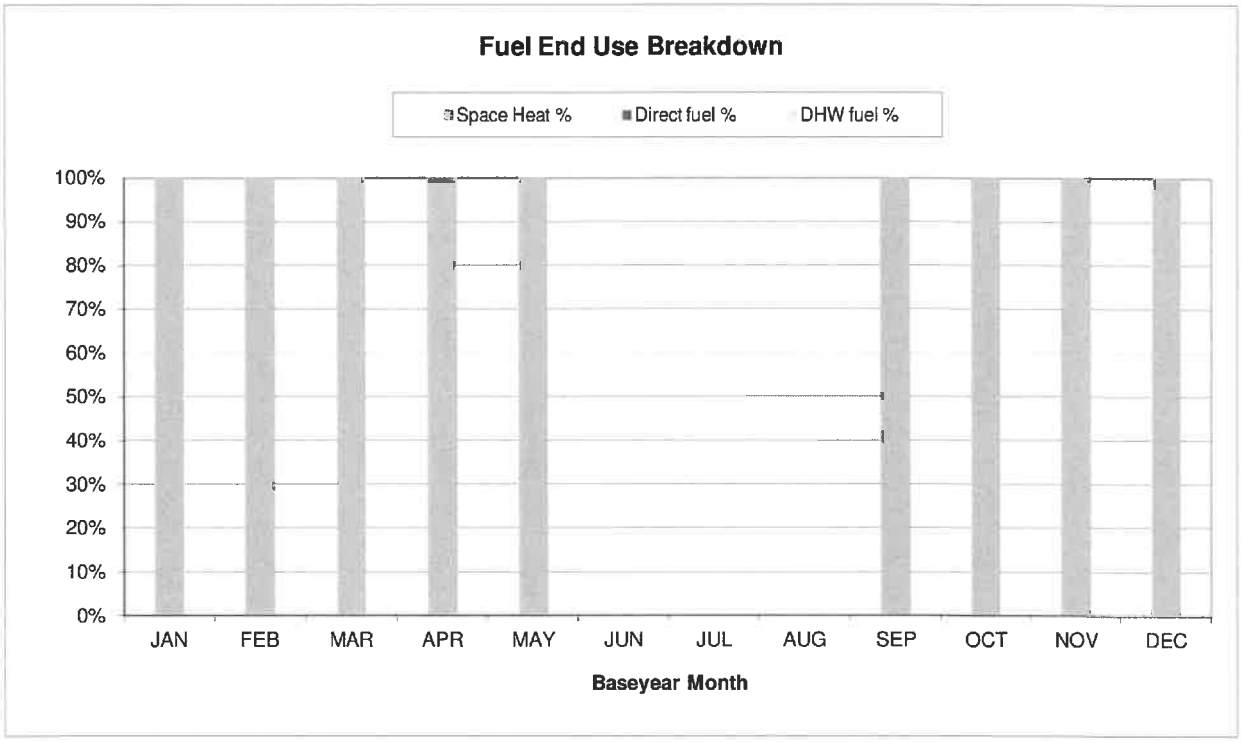
Month	*Base year BY therms*	*Adjusted therms*	*Adjusted %*	*Model therm*	*Space Heat %*	*Direct fuel %*	*DHW fuel %*	*check %*
JAN	2784	2266	-19%	2264	100.00%	0.00%	0.00%	100%
FEB	2637	1947	-26%	1947	100.00%	0.00%	0.00%	100%
MAR	2224	1697	-24%	1697	100.00%	0.00%	0.00%	100%
APR	1136	1008	-11%	1008	100.00%	0.00%	0.00%	100%
MAY	425	354	-17%	354	100.00%	0.00%	0.00%	100%
JUN	0	0	-	0	0.00%	-	-	0%
JUL	0	0	-	0	0.00%	-	-	0%
AUG	0	0	-	0	0.00%	-	-	0%
SEP	373	312	-17%	311	100.00%	0.00%	0.00%	100%
OCT	752	876	16%	876	100.00%	0.00%	0.00%	100%
NOV	1550	1330	-14%	1330	100.00%	0.00%	0.00%	100%
DEC	2270	1937	-15%	1937	100.00%	0.00%	0.00%	100%
OVERALL	14152	11728	-17%	11724	100.00%	0.00%	0.00%	100%



FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Output





FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Input — *System Input Parameters*

HEATING EQUIPMENT INPUT		
HEATING Plant Enable Criteria:	60	degree F
BOILER Existing Minimum Continuous Input (**not used**)		MBTU/Hr
BOILER Existing Maximum Continuous Input		MBTU/Hr
BOILER Exisitng Boiler Efficiency	80%	
BOILER New Boiler Maximum Gas Input		MBTU/Hr
BOILER New Boiler Efficiency	80.0%	
HEATING DHW Heater Efficiency	80%	
BUILDING CHARCTERISTICS		
BUILDING Overall Heat Transfer Rate:	5.8	kBTU/Hr-F
BUILDING Heating Load Supplied by Heating Plant	100%	

	PLANT DIVERSITY	
MONTH	COOLING	HEATING
JAN	0.00	0.74
FEB	0.00	0.72
MAR	0.00	0.69
APR	0.00	0.66
MAY	0.00	0.45
JUN	0.00	0.00
JUL	0.00	0.00
AUG	0.00	0.00
SEP	0.00	0.43
OCT	0.00	0.67
NOV	0.00	0.69
DEC	0.00	0.73

FOSSIL FUELS

NATURAL GAS Heating Value: N/A	100	kBtu/ccf
PROPANE Equivalent therms per gallon	1.387	therms/gal
PROPANE Equivalent unit therm cost:	1.442	$/therm

PROPOSED TEMPERATURE CONTROL SET POINTS

	sched1	sched2	sched3	sched4	sched5	sched6	sched7
JAN	66	72	66	58			58
FEB	66	72	66	58			58
MAR	66	72	66	58			58
APR	66	72	66	58			58
MAY	66	72	66	58			58
JUN	66	72	66	58			58
JUL					70	70	58
AUG					70	70	58
SEP	66	72	66	58			58
OCT	66	72	66	58			58
NOV	66	72	66	58			58
DEC	66	72	66	58			58

Upper BIN MidPoint	91	degree F
	8749	ADJUST
ANNUAL HOURS		
sched1	430	
sched2	1944	
sched3	864	
sched4	1943	
sched5	438	
sched6	615	
sched7	2515	

	Baseyear		30 Yr Avg	TMY2	Weather Adjusted		Interactive Adjustments			Adjusted Baseyear	
	Therms	HDD	HDD	HDD	d.f.	Therms	Light	Heat	Envelope	Therms	% adj.
JAN	2784	1573	1559	1541	0	2726	460	0	0	2266	-19%
FEB	2637	1490	1332	1347	0	2384	436	0	0	1947	-26%
MAR	2224	1257	1122	1167	0	2065	368	0	0	1697	-24%
APR	1136	642	655	676	0	1196	188	0	0	1008	-11%
MAY	425	240	280	331	0	425	70	0	0	354	-17%
JUN	0	0	0	0	0	0	0	0	0	0	-
JUL	0	0	0	0	0	0	0	0	0	0	-
AUG	0	0	0	0	0	0	0	0	0	0	-
SEP	373	211	209	292	0	373	62	0	0	312	-17%
OCT	752	425	563	565	0	1000	124	0	0	876	16%
NOV	1550	876	886	897	0	1587	256	0	0	1330	-14%
DEC	2270	1283	1343	1307	0	2313	376	0	0	1937	-15%
	14,152	7997	7949	8121		14069	2341	0	0	11728	-17%

FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Calibration *Thermal Use Data*

INDOOR AIR TEMPERATURE (HEATING), degrees F

MONTH	SCHEDULE							Calculated	Baseyear SH	Model SH	Percent
	sched1	sched2	sched3	sched4	sched5	sched6	sched7	therms	therms	therms	+/-
JAN	72	72	72	72			72	**11119**	2266	2,264	-0.1%
FEB	72	72	72	72			72	**10532**	1947	1,947	0.0%
MAR	72	72	72	72			72	**8885**	1697	1,697	0.0%
APR	72	72	72	72			72	**4538**	1008	1,008	0.0%
MAY	72	72	72	72			72	**1696**	354	354	-0.1%
JUN	72	72	72	72			72	**0**	0	0	0.0%
JUL					70	70	72	**0**	0	0	0.0%
AUG					70	70	72	**0**	0	0	0.0%
SEP	72	72	72	72			72	**1491**	312	311	-0.1%
OCT	72	72	72	72			72	**3004**	876	876	0.0%
NOV	72	72	72	72			72	**6192**	1330	1,330	0.0%
DEC	72	72	72	72			72	**9069**	1937	1,937	0.0%
	72	72	72	72	70	70	72	56,528	11,728	11,724	0.0%

DOMESTIC HOT WATER, HEATING DIVERSITY FACTOR

MONTH	SCHEDULE							Heater Capacit	Baseyear	Model	Thermal
	sched1	sched2	sched3	sched4	sched5	sched6	sched7	kBTU/Hr	therms	Therms	Calibration
JAN	**0**	**0**	**0**	**0**			**0**	**400**	2,266	2,264	-0.1%
FEB	**0**	**0**	**0**	**0**			**0**	400	1,947	1,947	0.0%
MAR	**0**	**0**	**0**	**0**			**0**	400	1,697	1,697	0.0%
APR	**0**	**0**	**0**	**0**			**0**	400	1,008	1,008	0.0%
MAY	**0**	**0**	**0**	**0**			**0**	400	354	354	-0.1%
JUN	**0**	**0**	**0**	**0**			**0**	400	-	0	0.0%
JUL					**0**	**0**	**0**	400	-	0	0.0%
AUG					**0**	**0**	**0**	400	-	0	0.0%
SEP	**0**	**0**	**0**	**0**			**0**	400	312	311	-0.1%
OCT	**0**	**0**	**0**	**0**			**0**	400	876	876	0.0%
NOV	**0**	**0**	**0**	**0**			**0**	400	1,330	1,330	0.0%
DEC	**0**	**0**	**0**	**0**			**0**	400	1,937	1,937	0.0%
									11,728	11,724	0.0%

DIRECT FUEL USAGE: KITCHEN EQUIPMENT, LAUNDRY, ETC. (THERMS)

MONTH	SCHEDULE							Direct fuel	BY_SH+Dir	Model	Percent
	sched1	sched2	sched3	sched4	sched5	sched6	sched7	therms	therms	therms	+/-
JAN	**0**	**0**	**0**	**0**			**0**	0	2,266	2,264	-0.1%
FEB	**0**	**0**	**0**	**0**			**0**	0	1,947	1,947	0.0%
MAR	**0**	**0**	**0**	**0**			**0**	0	1,697	1,697	0.0%
APR	**0**	**0**	**0**	**0**			**0**	0	1,008	1,008	0.0%
MAY	**0**	**0**	**0**	**0**			**0**	0	354	354	-0.1%
JUN	**0**	**0**	**0**	**0**			**0**	0	-	0	0.0%
JUL					**0**	**0**	**0**	0	-	0	0.0%
AUG					**0**	**0**	**0**	0	-	0	0.0%
SEP	**0**	**0**	**0**	**0**			**0**	0	312	311	-0.1%
OCT	**0**	**0**	**0**	**0**			**0**	0	876	876	0.0%
NOV	**0**	**0**	**0**	**0**			**0**	0	1,330	1,330	0.0%
DEC	**0**	**0**	**0**	**0**			**0**	0	1,937	1,937	0.0%
	0	0	0	0	0	0	0	0	11,728	11,724	0.0%

FIM #5 - Install Condensing Boiler - Municipal Bldg
Village of Lancaster EPC

Calibration *Thermal Use Data*

OTHER HEATING SYSTEM, HEATING DIVERSITY FACTOR

MONTH	SCHEDULE							Heater Capaci	Baseyear	Model	Thermal
	sched1	sched2	sched3	sched4	sched5	sched6	sched7	kBTU/Hr	therms	therms	Calibration
JAN	0	0	0	0			0	0	2,266	2,264	-0.1%
FEB	0	0	0	0			0	0	1,947	1,947	0.0%
MAR	0	0	0	0			0	0	1,697	1,697	0.0%
APR	0	0	0	0			0	0	1,008	1,008	0.0%
MAY	0	0	0	0			0	0	354	354	-0.1%
JUN	0	0	0	0			0	0	-	0	0.0%
JUL					0	0	0	0	-	0	0.0%
AUG					0	0	0	0	-	0	0.0%
SEP	0	0	0	0			0	0	312	311	-0.1%
OCT	0	0	0	0			0	0	876	876	0.0%
NOV	0	0	0	0			0	0	1,330	1,330	0.0%
DEC	0	0	0	0			0	0	1,937	1,937	0.0%
									11,728	11,724	0.0%

THERMAL LOADS: PLANT LOADS; OTHER THAN SPACE HEATING, kBTU/Hr

MONTH	SCHEDULE							Other	Baseyear	Model	Percent
	sched1	sched2	sched3	sched4	sched5	sched6	sched7	therms	therms	therms	+/-
JAN	0	0	0	0			0	0	2,266	2,264	-0.1%
FEB	0	0	0	0			0	0	1,947	1,947	0.0%
MAR	0	0	0	0			0	0	1,697	1,697	0.0%
APR	0	0	0	0			0	0	1,008	1,008	0.0%
MAY	0	0	0	0			0	0	354	354	-0.1%
JUN	0	0	0	0			0	0	-	0	0.0%
JUL					0	0	0	0	-	0	0.0%
AUG					0	0	0	0	-	0	0.0%
SEP	0	0	0	0			0	0	312	311	-0.1%
OCT	0	0	0	0			0	0	876	876	0.0%
NOV	0	0	0	0			0	0	1,330	1,330	0.0%
DEC	0	0	0	0			0	0	1,937	1,937	0.0%
	0	0	0	0	0	0	0	0	11,728	11,724	0.0%

DPW - Hot Water Boiler Upgrades
Village of Lancaster EPC

INPUTS

Baseline		
Baseline Total Annual Consump	20,717	therm
DHW % of Total	15%	
Gas RTUs % of Total	0%	
Baseline Boiler Annual Consum	17,609	therm

Utility Costs		
Natural Gas Rate:	$ 0.60	per therm

Equipment		
Existing Boiler Thermal Efficien	77.0%	
Proposed Boiler Thermal Efficie	92.2%	

Bradford White 3,108

Direct fired gas unit heaters found in the Maintenance Room

RBI Flexcore Boiler Cutsheet, AHRI Peak Boiler Efficiency: 96.8% @ 80F/60% load

Building Area 18,426 sqft

DPW - Hot Water Boiler Upgrades

Village of Lancaster EPC

	Existing		Proposed	
Model#			RBI CK 1500	
Existing Boiler Input:	1,700,000	Btu/hr		
	1,700	kBtu/hr	1,500	kBtu/hr
Existing Boiler Output	1,380,000	Btu/hr		
	1,380	kBtu/hr	1,427	kBtu/hr
% of Boiler Fuel Use	85%		100%	
	1,761	MMBtu/yr	1049	MMBtu/yr
Existing Boiler Thermal Efficiency	77%		92.2%	
Actual Boiler Capacity	1,309	kBtu/hr	1,383	kBtu/hr
Jacket Losses	1%		0.5%	
Boiler is hot when OAT<	60.0	°F	60.0	°F
Hours/ Yr. Unit is Hot	5,637	hrs.	5,637	hrs
Off-Cycle Flue Losses	0.5%		0.5%	
Off-Cycle Hours/Year	4,498	hrs.	4,498	hrs
Jacket Losses	74	MMBtu/yr	39	MMBtu/yr
Off-Cycle Flue Losses	29	MMBtu/yr	31	MMBtu/yr
Useful Heat Output	1,253	MMBtu/yr	1,049	MMBtu/yr
Proposed Boiler Input			1,215	MMBtu/yr

	Annual Fuel Consumption (MMBtu)	(Therms)	Annual Cost
Present:	1,761	17,609	$ 10,566
- Fuel Saved by Other FIMs	203	2,033	$ 1,220
Proposed:	1,215	12,146	$ 7,288
Annual Savings:	**343**	**3,431**	**$ 2,059**

Adjustments for Other Measures:

Fuel Savings

203 MMBtu/yr Building Air Sealing

203 MMBtu/yr

1,253 MMBtu Useful Heat Output (present)

1,049 MMBTU Req'd from New Boilers

Jacket Losses

0.50% for low water volume boilers
1.00% for scotch marine type fire tube boilers
1.50% for cast iron sectional boilers (varies considerably)
2.00% for steel firebox boilers
3.00% for brick-set firebox boilers

Off-Cycle Flue Losses

0.50% for power burners and low water volume boilers
0.90% for power burners on scotch marine type fire tube boilers
3.00% for atmospheric burners

Off-Cycle Flue Losses = Boiler kBtuh Output x 1000 x % Off-Cycle Flue Losses x Hrs Off-Cycle per Year / 1,000,000
Jacket Losses = Boiler kBtuh Output x 1000 x % Jacket Losses x Hrs Hot per Year / 1,000,000
Useful Heat Output = (Htg Fuel Use x BTU per Unit x Present Efficiency / 1,000,000) - Off Cycle Losses - Jacket Losses
Proposed Annual Fuel Consumption = (Proposed Off-Cycle & Jacket Losses + Useful Heat Output) / Proposed Efficiency x 1,000,000 / BTU per Unit

DPW - Hot Water Boiler Upgrades

Village of Lancaster EPC

Weather Data			Hot Water		Efficiency	
ΔT °F	Mid-pts °F	Total Hours	HWST °F	HWRT °F	Existing Boiler Efficiency	Proposed Condensing Boiler Efficiency
95 to 100	97.5	1			-	-
90 to 95	92.5	10			-	-
85 to 90	87.5	66			-	-
80 to 85	82.5	309			-	-
75 to 80	77.5	515			-	-
70 to 75	72.5	469			-	-
65 to 70	67.5	832			-	-
60 to 65	62.5	921	120	100	76%	94.5%
55 to 60	57.5	702	120	100	76%	94.5%
50 to 55	52.5	568	120	100	76%	94.5%
45 to 50	47.5	455	120	100	76%	94.5%
40 to 45	42.5	647	127	107	76%	93.0%
35 to 40	37.5	992	133	113	76%	91.5%
30 to 35	32.5	859	140	120	76%	90.8%
25 to 30	27.5	440	147	127	76%	90.0%
20 to 25	22.5	405	153	133	76%	89.5%
15 to 20	17.5	382	160	140	76%	88.5%
10 to 15	12.5	228	167	147	76%	88.0%
5 to 10	7.5	119	173	153	76%	87.5%
0 to 5	2.5	27	180	160	76%	87.5%
-5 to 0	-2.5	10	180	160	76%	87.5%

Averaged Weighted Existing Boiler Efficiency	76.0%
Averaged Weighted Proposed Boiler Efficiency	92.2%

Village of Lancaster
DPW
Repalce Existing Hot Water Pumps with High Efficiency HW Pumps

Background

Two constant flow inline circulating pumps provide heating hot water to the building. The pumps are in fair condition, however it was noted during our walkthrough that they undergo some type of repair or replacement yearly. Any modification or replacement of the building boiler plant would most likely require modifications or replacement of existing piping and pumps within the boiler room.
This spreadsheet calculates the savings due to following:
- Conversion from Constant volume HW system to Variable volume HW system and converting 3 way to 2 way valves.
- Converting PSC to ECM Motors on HW Circulator Pumps

Energy Savings Calculations

Building	Equipment	Type	Qty	hp	Efficiency	Load Factor	kW	Hours	kWh	
WTP	HW Pump (Inline)	Primary	1	3	80%	63%	1.8	3180	5,605	M-F; 7AM TO 7PM
WTP	HW Pump (Inline)	Secondary	0	0	80%	63%	0	3157		

HW Pumping Energy

			Constant Speed			Variable Speed			Savings	
% Load	Percent of Op. Hours	Op. Hours	% Power	Total kW	Annual kWh	% Power	Total kW	Annual kWh	Total kW	Total kWh
100%	1%	32	100%	1.8	57	100%	1.1	36	0.68	21
75%	42%	1336	100%	1.8	2,404	46%	0.5	691	1.28	1,713
50%	45%	1431	100%	1.8	2,576	20%	0.2	322	1.58	2,254
25%	12%	382	100%	1.8	687	20%	0.2	86	1.58	601
		3180			5724		1.125	1135		4,589

Energy Savings Summary:

Power Savings	0.68 kW
Energy Savings	4589 kWh

Notes:

(1) Motor load data is used if available. Otherwise the default is taken from the following list.

Air Comp	0.8	Ref: PG&E Resource Binder
Exhaust Fan	0.63	Ref: PG&E Resource Binder
Fan	0.63	Ref: PG&E Resource Binder
Industrial Fan	0.78	Ref: PG&E Resource Binder
Misc	0.75	JWD assumption
Pump	0.58	Ref: PG&E Resource Binder

Variable Speed Part Load Energy Modifier
The following information is taken from the DOE-2.1 Compliance Supplement.

% Flow	Constant Volume	VFD	Inlet Vanes BI/AF	Vane Axial Variable Pitch	Outlet Dampers BI/AF
a	1	0.2197619	0.584345	0.2120476	0.2271429
b	0	-0.874784	-0.57917	-0.569286	1.1789286
c	0	1.6525974	0.970238	1.3452381	-0.410714
d	0	0	0	0	0

AF - airfoil
BI - backward inclined
FC - forward curved
VFD - variable frequency drive
x = percent motor speed (proportional to percent flow)
y = part load energy modifier
kW (x) = kW (full speed) * y(x)
$y(x) = a + bx + cx^2 + dx^3$

Fan Flow Control Efficiencies

No Control	100%	Inlet vane, discharge damper
Inlet Vanes	92%	and VFD efficiencies are based
Fan Discharge Dampers	90%	on information from EPRI
Variable Frequency Drive	98%	publications.
Variable Pitch, Vane Axial	100%	

Motor Efficiencies

Typical PSC fractional hp motor	50%
Typical EC fractional hp motor	80%
National Grid estimate	3240
HW VFD Exponent	2.7

(2) Retrofit Analysis: Nameplate efficiency is used if available. Otherwise the default is taken from the New York Department of Public Service "New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs," October 15, 2010

(3) The baseline efficiency of a standard permanent split-capacitor (PSC) motor is estimated to be 50%.
The measure efficiency of a fractional horsepower EC motor is estimated to be 80%.
High efficiency circulators may include better impeller design that will increasekWh savings, but may have a negative impact on gas consumption. These effectsare ignored.
Annual heating hours are based on a continuously running circulator. Savingswill be less if the circulator cycles on and off with a call for heat.

(4) Calculated as: kW = Qty x Hp x 0.746 kW/hp x Variable Speed Part Load Energy Modifier x Fan Flow Control Efficiencies (Constant/Variable) x Load Factor / Baseline Efficiency

(5) Calculated as: kWh/yr = Baseline Load kW x Annual Operating Hours

MUNICIPAL BUILDING - RTU UPGRADES

Village of Lancaster EPC

INPUTS

Assumptions	
Cooling Months for Demand Savings:	4 months
Effective Full-Load Cooling Hours (w/o Economizer)	587 hours

Utility Costs			
Electric Consumption Rate:	$	0.069	per kWh
Electric Demand Rate:	$	9.35	per kW

Coincidence Factor:	0.8

COOLING SAVINGS

Unit	Monthly Demand Savings	Annual Consumption Savings
	kW	*kWh*
RTU-1	0.8	840
RTU-2	1.0	1,184
RTU-3	1.0	1,184
RTU-4	1.5	1,606
TOTAL	**4.4**	**4,814**

Unit	Cooling Capacity		Existing Efficiency		Proposed Efficiency		verified	Comments
	MBH	*tons*	*EER*	*SEER*	*EER*	*IEER*		
RTU-1	36	3.0	9.2	10.0	12.2	14.5	x	*Only SEER Known*
RTU-2	48	4.0	9.2	10.0	12.2	15.0	x	*Only SEER Known*
RTU-3	48	4.0	9.2	10.0	12.2	15.0	x	*Only SEER Known*
RTU-4	90	7.5	8.9	9.2	11.0	12.2	x	*Existing Unit and Proposed Unit cutheets*

TOTAL SAVINGS

Monthly Demand	**4.4**	kW
	$ 163	
Annual Consumption	**4,814**	kWh
	$ 334	
Total Cost Savings	**$ 497**	

ASSUMPTIONS

- Methods for calculating cooling savings are based on equations found on page 129 of the NY Tech Manual (2010)
- Cooling savings is calculated using the following formulas:

  ΔkW = tons x ((12/EER ex) - (12/EER new)) x Coincidence Factor

  ΔkWh = tons x ((12/SEER ex) - (12/SEER new)) x Effective Full Load Cooling Hours
- Effective Full Load Cooling Hours (EFLH) based on CAV systems w/ economizers as found in NY Tech Manual (2010) pg 432
- EER = -0.02x SEER^2 +1.12 x SEER

DPW BUILDING - RTU UPGRADES

Village of Lancaster EPC

INPUTS

Assumptions	
Cooling Months for Demand Savings:	4 months
Effective Full-Load Cooling Hours (w/ Economize	587 hours
Effective Full-Load Cooling Hours (w/ Economize	587 hours
Coincidence Factor:	0.8

Utility Costs			
Electric Consumption Rate:	$	0.067	per kWh
Electric Demand Rate:	$	9.35	per kW

COOLING SAVINGS

Unit	Monthly Demand Savings	Annual Consumption Savings
	kW	*kWh*
RTU-1	0.8	840
RTU-2	1.0	1,184
RTU-3		
RTU-4		
RTU-5		
TOTAL	**1.8**	**2,024**

Unit	Cooling Capacity		Existing Efficiency		Proposed Efficiency		verified	Comments
	MBH	*tons*	*EER*	*SEER*	*EER*	*IEER*		
RTU-1	36	3.0	9.2	10.0	12.2	14.5	x	*Only SEER Known*
RTU-2	48	4.0	9.2	10.0	12.2	15.0	x	*Only SEER Known*
RTU-3	0							
RTU-4	0							
RTU-5	0							

TOTAL SAVINGS

Monthly Demand	**1.8**	kW
	$ **67**	
Annual Consumption	**2,024**	kWh
	$ **135**	
Total Cost Savings	$ **203**	

ASSUMPTIONS

- Methods for calculating cooling savings are based on equations found on page 129 of the NY Tech Manual (2010)
- Cooling savings is calculated using the following formulas:

  ΔkW = tons x ((12/EER ex) - (12/EER new)) x Coincidence Factor

  ΔkWh = tons x ((12/SEER ex) - (12/SEER new)) x Effective Full Load Cooling Hours
- Effective Full Load Cooling Hours (EFLH) based on CAV systems w/o and w/ economizers as found in NY Tech Manual (2010) pg 432
- EER = -0.02x SEER^2 +1.12 x SEER

FIM#7 - Building Management System
Municipal Bldg
Energy Savings from removing Air Compressor

Inputs	Municipal Bldg
Power	3
Efficiency	85%
Load factor	80%
Duty Cycling	20%
Operational Period	8760
Total Energy Savings	3,690

FIM #9 - PTAC REPLACEMENTS W/ 5TON UNIT - MUNICPAL BLDG
Village of Lancaster EPC

	kW	kWh	Therms
PTACs Repl with RTU	17.62021	16,778	-621
PTACs Replacement	3.91	3,825	0
PTAC Retrofit	21.53	20,604	-621

RM #X - PTAC REPLACEMENTS W/ 6TON UNIT - MUNICIPAL BLDG
Village of Lancaster EPC

calculated
input

INPUTS

Assumptions	
Cooling Months for Demand Savings:	4 months
Heating Months for Demand Savings:	6 months
Effective Full-Load Cooling Hours:	587 hours
Effective Full-Load Heating Hours:	760 hours
Coincidence Factor	0.8

Unit	Office Name	Cooling (Btuh)	Heating (Btuh)
PTEA 09	Village Attorney	9,000	16,000
PTEA 12	Mayor's Office	10,000	12,000
PTEA 12	Pros.& Asst DA	10,000	10,000
PTEA 15	Trustees Office	13,000	14,000
PTEA 15	Conference Room/Jury	14,000	14,000

Existing Capacity			Existing Efficiences			Proposed Capacity			Proposed Efficiences			
Cooling		Heating	Cooling		Heating	Cooling		Heating	Cooling		Heating	
MBH	*tons*	*kW*	*EER*	*SEER*	*Electric Resistance*	*MBH*	*tons*	*MBH*	*EER*	*SEER*	*Indirect Gas Fired DX Efficiency*	
9	0.8	5	7.7	13.0	100%							5%
10	0.8	4	7.7	13.0	100%							4%
10	0.8	3	7.7	13.0	100%	67	5.6	97	12.2	15.0	81%	3%
13	1.1	4	7.7	13.0	100%							4%
14	1.2	4	7.7	13.0	100%							4%
56.0	4.7	19				67	5.6	97				

66 MBTU

Utility Costs		
Electric Consumption Rate	$ 0.096	per kWh
Electric Demand Rate.	$ 9.35	per kW
NG Average Rate	$ 0.60	$/therm

SAVINGS

	Cooling Savings		Heating Consumption		
Unit	Monthly Demand	Annual Consumption	Existing Monthly Demand	Existing Annual Consumption	Proposed NG Annual Consumption
	kW	*kWh*	*kW*	*kWh*	*therms*
Village Attorney	0.3	334	3.8	3,564	
Mayor's Office	0.4	371	2.8	2,673	
Pros.& Asst DA	0.4	371	2.3	2,227	621
Trustees Office	0.5	482	3.3	3,118	
Conference Room/Jury	0.5	519	3.3	3,118	
TOTAL	**2.1**	**2,078**	**15.5**	**14,700**	**621**

TOTAL SAVINGS

Monthly Demand	**2.1**	kW cooling
	15.5	kW heating
	$ 988	total
Annual Consumption	**16,778**	kWh cooling
	(621)	Gas therms
	$ 1,231	total
Total Cost Savings	**$ 2,218**	total

ASSUMPTIONS

- Methods for calculating cooling savings are based on equations found on page 1.29 of the NY Tech Manual (2010)
- Cooling savings is calculated using the following formulas:
  - ΔkW = tons x ((12/EER ex) - (12/EER new)) x Coincidence Factor
  - ΔkWh = tons x ((12/SEER ex) - (12/SEER new)) x Effective Full Load Cooling Hours
- Heating savings is calculated using the following formulas:
  - ΔkW = MBH x ((1/HSPF ex) - (1/HSPF new)) x Effective Full Load Heating Hours

ECM #X - (2) PTAC REPLACEMENTS - MUNICPAL BLDG
Village of Lancaster EPC

calculated
input

INPUTS

Assumptions	
Cooling Months for Demand Savings:	4 months
Heating Months for Demand Savings:	6 months
Effective Full-Load Cooling Hours:	587 hours
Effective Full-Load Heating Hours:	760 hours
Coincidence Factor:	0.8

Utility Costs			
Electric Consumption Rate:	$	0.096	per kWh
Electric Demand Rate:	$	9.35	per kW
NG Average Rate	$	0.60	$/therm

Unit	Office Name	Cooling (Btuh)	Heating (Btuh)
PTEA 09	Village Justice	9,000	16,000
PTEA 15	Assesor/Economic Dev	10,000	12,000

Existing Capacity			Existing Efficiences			Proposed Capacity			Proposed Efficiences		
Cooling		Heating	Cooling		Heating	Cooling		Heating	Cooling		Heating
MBH	*tons*	*kW*	*EER*	*SEER*	*Electric Resistance*	*MBH*	*tons*	*kW*	*EER*	*SEER*	*Electric Resistance*
9	0.8	4.7	7.7	13.0	100%	10	0.8	1.5	11.3	15.0	100%
10	0.8	3.5	7.7	13.0	100%	13	1.1	2.5	11.3	15.0	100%
19	1.6	8.2				22.2	1.9	4.1			

SAVINGS

Unit	Cooling Savings		Heating Savings	
	Monthly Demand	Annual Consumption	Monthly Demand	Annual Consumption
	kW	kWh	kW	kWh
Village Attorney	0.3	334	2.5	2,348
Mayor's Office	0.3	371	0.8	773
TOTAL	**0.6**	**705**	**3.3**	**3,121**

TOTAL SAVINGS

Monthly Demand	**0.6**	kW cooling
	3.3	kW heating
	$ 208	total
Annual Consumption	**705**	kWh cooling
	3,121	kWh heating
	$ 365	total
Total Cost Savings	**$ 573**	total

ASSUMPTIONS

- Methods for calculating cooling savings are based on equations found on page 129 of the NY Tech Manual (2010)
- Cooling savings is calculated using the following formulas:
  - ΔkW = tons x ((12/EER ex) - (12/EER new)) x Coincidence Factor
  - ΔkWh = tons x ((12/SEER ex) - (12/SEER new)) x Effective Full Load Cooling Hours
- Heating savings is calculated using the following formulas:
  - ΔkW = MBH x ((1/Electric Resistance Heating Efficiency (100%)) - (1/HSPF new)) x Effective Full Load Heating Hours

7.0 EQUIPMENT CUT SHEETS AND SUPPORTING DOCUMENTATION

Streetworks

DESCRIPTION

The Verdeon LED roadway luminaire combines optical performance, energy efficiency, and outstanding versatility to meet the requirements of any roadway application. Advanced optical technology delivers unparalleled uniformity, scalability, and budget-beating operating costs for municipal streets and highways. UL/cUL listed for wet locations with an optional IP66 enclosure rating available.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Construction
Heavy-duty die-cast aluminum housing and door. Tool-less entry, hinged removable door for easy maintenance. 3G vibration rated.

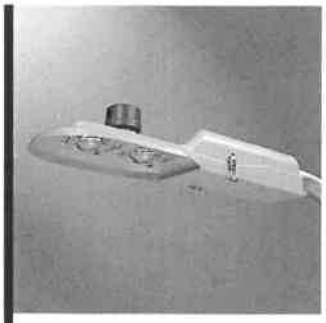
Optics
Optics are precisely designed to shape the distribution maximizing efficiency and fixture spacing. Offered standard in 4000K (+/- 275K) CCT and 70 CRI. Optional 5700K CCT, 5000K CCTand 3000K CCT are available.

Electrical
120-277V 50/60Hz, 347V 60Hz or 480V 60Hz operation. 10kV/10kA common- and differential- mode surge protection available. Thermal management transfers heat away from the LED source for optimal efficiency, light output and lumen maintenance. Operates in ambient temperatures from -40°C to 40°C. 50°C HA (high ambient) option available. Standard three-position tunnel type terminal block. LED modules are IP66 rated.

Mounting
Two-bolt/one-bracket slipfitter with cast-in pipe stop and 2.5° leveling steps. Four-bolt/two-clamp mounting option. Fixed-in-place bird guard seals around 1-1/4" to 2" (1-5/8" to 2-3/8" O.D.) mounting arms. Optional 15" pole mount arm available with round pole adapter and mounting hardware included.

Finish
Housing and cast parts finished in five-stage super TGIC polyester powder coat paint, 2.5 mil nominal thickness for superior protection against fade and wear. Consult your lighting representative at Eaton for a complete selection of standard colors.

Warranty
Five-year warranty.



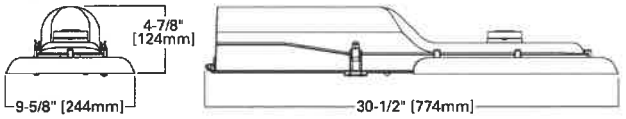
VERD VERDEON

LED

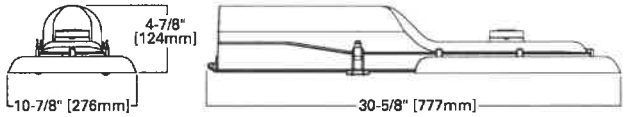
ROADWAY LUMINAIRE

DIMENSIONS

VERD

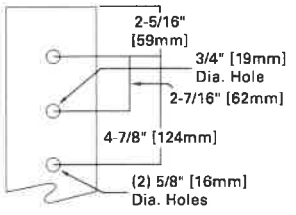


VERD-G



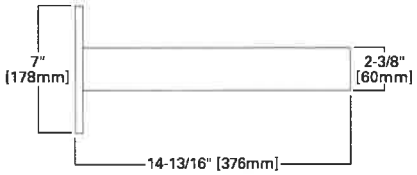
ARM DRILLING

TYPE "M"



OPTIONAL ARM

15" Straight Arm



CERTIFICATION DATA

UL and cUL Wet Location Listed
IP66-Rated Optics
3G Vibration Rated
ISO 9001
DesignLights Consortium® Qualified*

ENERGY DATA

Electronic LED Driver
0.9 Power Factor
<20% Total Harmonic Distortion
120-277V/50 and 60Hz, 347V 60Hz, 480V 60Hz
-40°C Minimum Temperature Rating
+40°C Ambient Temperature Rating

EPA

Effective Projected Area (Sq. Ft.): 0.5

SHIPPING DATA

Approximate Net Weight:
20 lbs. (9.1 kgs.)

Powering Business Worldwide

*www.designlights.org

POWER AND LUMENS

Light Engine		A016	A018	A01	A028	A02	G-A028	G-A02
Power (Watts)		36	51	64	72	92	103	143
Current (a) @ 120V		0.32	0.45	0.57	0.64	0.81	0.91	1.26
Current (a) @ 277V		0.15	0.20	0.25	0.29	0.64	0.40	0.53
Power (Watts)		44	59	--	83	100	113	154
Current (a) @ 347V		0.13	0.17	--	0.24	0.28	0.33	0.45
Current (a) @ 480V		0.09	0.13	--	0.17	0.21	0.24	0.33
Optics								
Type II	Lumens	3,855	4,936	5,839	7,858	9,294	12,064	15,332
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B2-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G3
Type III	Lumens	3,775	4,833	5,716	7,693	9,099	11,946	15,182
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B2-U0-G2	B2-U0-G2	B2-U0-G2	B2-U0-G2
Type IV	Lumens	3,785	4,846	5,732	7,714	9,123	11,944	15,180
	BUG Rating	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G3	B2-U0-G4
Type V	Lumens	3,864	4,948	5,852	7,876	9,315	12,137	15,425
	BUG Rating	B3-U0-G2	B3-U0-G2	B3-U0-G2	B3-U0-G3	B4-U0-G3	B4-U0-G3	B4-U0-G3

NOTE: Lumen output for AP Grey fixture color, 120-277V.

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (50,000 hours)	Theoretical L70 (Hours)
A01*		
25°C	>88%	>127,000
40°C	>82%	>87,000
A018, A016, A02, & A028		
Ambient Temperature	**TM-21 Lumen Maintenance (50,000 hours)**	**Theoretical L70 (Hours)**
25°C	>92%	>200,000
40°C	>90%	>145,000
G-A02 & G-A028		
Ambient Temperature	**TM-21 Lumen Maintenance (60,000 hours)**	**Theoretical L70 (Hours)**
25°C	>91%	>250,000
40°C	>90%	>200,000

* A01 Not available in 347V or 480V.

LUMEN MULTIPLIER

Ambient Temperature	Lumen Multiplier
0°C	1.02
10°C	1.01
25°C	1.00
40°C	0.99
50°C	0.97

ORDERING INFORMATION

Sample Number: VERD-A018-D-U-T2-4N7-AP

Product Family [1,2]	Light Engine [3]	Driver [5]	Voltage	Distribution
VERD=Verdeon	**A01**=1 LED, Full Output [4] **A018**=1 LED, Approximately 80% Output **A016**=1 LED, Approximately 60% Output **A02**=2 LEDs, Full Output **A028**=2 LEDs, Approximately 80% Output **G-A02**=High Lumen, 2 LEDs, Full Output **G-A028**=High Lumen, 2 LEDs, Approximately 80% Output	**E**=Non-Dimming **D**=Dimming (0-10V) [6]	**U**=Universal (120-277V) **8**=480V [7,8] **9**=347V [7]	**T2**=Type II **T3**=Type III **T4**=Type IV **T5**=Type V

Options (Add as Suffix)	**Color**	**Accessories** (Order Separately)
7030=70 CRI / 3000K CCT [9] **7060**=70 CRI / 5700K CCT [9] **4**=NEMA Twistlock Photocontrol Receptacle **4N7**=NEMA 7-PIN Twistlock Photocontrol Receptacle [10] **10K**=10kV UL 1449 Surge Protective Device **10MSP**=10kV MOV Surge Protective Device **IP66**=IP66 Rated Housing **HA**=50°C High Ambient Temperature **MS/DIM-L08**=Motion Sensor for Dimming Operation, Maximum 8' Mounting Height [10,11,12] **MS/DIM-L20**=Motion Sensor for Dimming Operation, Maximum 9' - 20' Mounting Height [10,11,12] **MS/DIM-L40**=Motion Sensor for Dimming Operation, Maximum 21' - 40' Mounting Height [10,11,12] **LWR-LN**=Factory Installed LumaWatt RF Dimming Control System (Mounting Height 16' and Up) [13,14] **LWR-LW**=Factory Installed LumaWatt RF Dimming Control System (Mounting Height below 16') [13,14] **K**=Level Indicator **4B**=Four-bolt, Two-clamp Mounting **A15**=Arm Included (15" Straight Arm) [15]	**AP**=Grey (Standard) **BZ**=Bronze **BK**=Black **DP**=Dark Platinum **GM**=Graphite Metallic **WH**=White	**OA1223**=10kV UL 1449 Surge Module Replacement **OA/RA1013**=Photocontrol Shorting Cap **OA/RA1014**=NEMA Photocontrol - 120V **OA/RA1016**=NEMA Photocontrol - Multi-Tap **OA/RA1027**=NEMA Photocontrol - 480V **OA/RA1201**=NEMA Photocontrol - 347V **FSIR-100**=Wireless Configuration Tool for Motion Sensor [16] **HS-VERD**=Verdeon House Side Shield **VGS-F/B**=Vertical Glare Shield, Front/Back **VGS-SIDE**=Vertical Glare Shield, Side

NOTES:

1. Customer is responsible for engineering analysis to confirm pole and fixture compatiblity for all applications. Refer to our white paper WP513001EN for additional support information.
2. DesignLights Consortium® Qualified. Refer to www.designlights.org qualified products list under family models for details.
3. Standard 4000K CCT and 70 CRI.
4. Not available in 347V or 480V.
5. Consult factory for driver surge protection values.
6. Dimming leads will be capped except when 4N7 or motion sensor option is specified.
7. Not available with A01 light engine.
8. Only for use with 480V Wye systems. Per NEC, not for use with ungrounded systems, impedance grounded systems or corner grounded systems (commonly known as Three Phase Three Wire Delta, Three Phase High Leg Delta and Three Phase Corner Grounded Delta systems).
9. Extended lead times apply. Use dedicated IES files for 3000K and 5700K when performing layouts. These files are published on the VERD Verdeon luminaire product page on the website.
10. Must specify dimming driver.
11. Not available with 4B option. Sensor mounted externally. Consult factory for more information.
12. The FSIR-100 accessory is required to adjust parameters.
13. LumaWatt wireless sensors are factory installed and require network components RF-EM-1, RF-GW-1 and RF-ROUT-1 in appropriate quantities. See website for LumaWatt application information.
14. LumaWatt wireless system is not available with photocontrol receptacle (not required).
15. Round pole adapter and mounting hardware included. "M" drill pattern.
16. This tool enables adjustment of parameters including high and low modes, sensitivity, time delay, cutoff and more. Consult your lighting representative at Eaton for more information.

Powering Business Worldwide

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

LED Linear Tube-T8 4Foot

4ft / 13W / 140LPW / 4000K / 5000K

Non-Shunted-Solution

Model: SLT813P4XX-S

> Features in Performance

Superior lumen efficacy, up to 140lm/W,Industrial Class

Wide beam with uniform distribution of light

> Green and Sustainable

No mercury

No glass

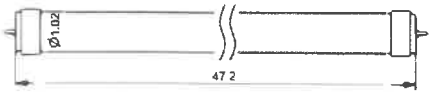
8 years limited warranty

> Energy Saving

Over 60% energy savings compared to fluorescent

Reduce heat cost in HVAC system

> Dimension



section

Specifications

Model No.	**SLT813P4XX-S**
Power	13W
Volts	120-277V
Frequency	50/60Hz
Lumens	1820/1820lm
Light efficacy	140/140lm/W
CCT	4000K/5000K
CRI	82
Power Factor	>0.9
Beam angle	240°
Finishing	Frosted
Working temperature	-20℃ - +40℃
Lamp base	G13
Dimming function	No
Certification	UL DLC(JAN)
Warranty	8 years

> Application

Office, Education, Healthcare, Industrial,

Cove Lighting, Parking Garage

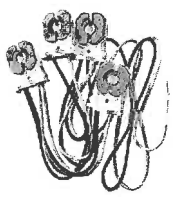
(suitable for general lighting application)

> Packaging

1pc/single box

25pcs/outer carton

Accessories

Model Number	Picture	Specs	Certificates
SLT8K-1		G13 push-through lampholders Lamp axis: 23mm Casing: PC, white, frontplate: PBT GF, white Weight:6g	UL
SLT8K-N		N can be 2,3,4,6. For example, 6-lamp socket kit with UL certified wires	UL

LED Linear Tube-T8 2Foot

2ft / 9W / 105LPW / 4000K / 5000K

Non-Shunted-Solution

Model: SLT809P2XX

> Features in Performance

High lumen efficacy, 105lm/W

Wide beam with uniform distribution of light

> Green and Sustainable

No mercury

No glass

6 years limited warranty

> Energy Saving

Equivalent light levels to a standard 18W 2foot fluorescent

Over 50% energy savings compared to fluorescent

Reduce heat cost in HVAC system

Specifications

Model No.	**SLT809P2XX**
Power	9W
Volts	100-277V
Frequency	50/60Hz
Lumens	950lm
Light efficacy	105lm/W
CCT	4000K/5000K
CRI	82
Power Factor	>0.9
Beam angle	240°
Finishing	Frosted
Working temperature	-20℃~+40℃
Lamp base	G13
Dimming function	No
Certification	UL & DLC
Warranty	6 years

> Application

Office, Education, Healthcare, Industrial,

Cove Lighting, Parking Garage

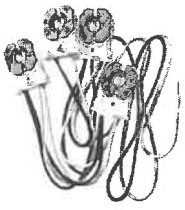
(suitable for general lighting application)

> Packaging

1pc/single box

25pcs/outer carton

Accessories

Model Number	Picture	Specs	Certificates
SLT8K-1		G13 push-through lampholders Lamp axis: 23mm Casing: PC, white, frontplate: PBT GF, white Weight:6g	UL
SLT8K-N		N can be 2,3,4,6. For example, 6-lamp socket kit with UL certified wires	UL

Web: www.starcolighting.com

Email: info@starcolighting.com

LED Security Wall Pack 17W AC110-277V 5000K

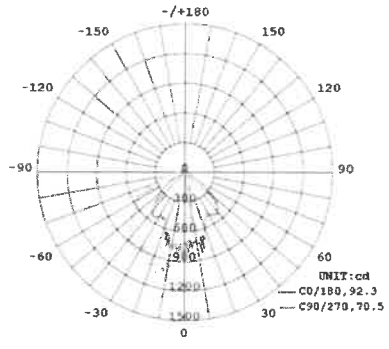
Product description: LED Security Wall Pack 17W AC110-277V 5000K
Model Name: AAWP17W110V5K
Order SKU: 700043

◊ Features

- Energy savings up to 70% vs 120W incandescent
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Built-in UL class 2 driver, photocell optional

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	17W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	142mA Max
Power Factor	>0.82
Luminous Flux (LM)	1,700LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>82
Beam Angle	80D
Lamp Efficacy (LM/W)	100LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	212.94*193.3*89.5
IP Rating	65
Operating Temperature	-40 to 55 degC
Housing Material	Aluminum
Certificate	UL, CUL, DLC, Rohs



	C0/180	C45/225	C90/270	C135/315	AVG
Beam Angle (50% Imax):	92.3	74.7	70.5	75.7	78.3
Field Angle (10% Imax):	125.3	114.8	110.4	115.9	116.6

Angle: 78.30°. Flux out: 827.2 lm.

Height (m)	Diameter (cm)	E_{avg}(lx)	E_{max}(lx)
0.5	81.4	1496.0	4012.0
1.0	162.8	374.0	1003.0
1.5	244.2	166.2	445.8
2.0	325.7	93.5	250.8
2.5	407.1	59.8	160.5
3.0	488.5	41.6	111.5
3.5	569.9	30.5	81.9
4.0	651.3	23.4	62.7
4.5	732.7	18.5	49.5
5.0	814.1	15.0	40.1

LED Classic Wall Pack 70W AC110-277V 5000K

Product description: LED Classic Wall Pack 70W AC110-277V 5000K
Model Name: AAWP70W110V5K
Order SKU: 700037

◊ Features

- Energy savings up to 70% vs 250W MH or 265W HID
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Built in photocell (optional) save more energy on day light

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	70W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	700mA Max
Power Factor	>0.86
Luminous Flux (LM)	6,032LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>75
Beam Angle	90D
Lamp Efficacy (LM/W)	85LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	361*377*332
IP Rating	65
Operating Temperature	-40 to 55 degC
Housing Material	Aluminum
Certificate	UL, CUL, DLC, Rohs

LED Classic Wall Pack 90W AC110-277V 5000K

Product description: LED Classic Wall Pack 90W AC110-277V 5000K
Model Name: AAWP90W110V5K
Order SKU: 700048

◊ Features

- Energy savings up to 70% vs 250W MH or 265W HID
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Built-in UL class 2 driver, photocell optional

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	90W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	750mA Max
Power Factor	>0.86
Luminous Flux (LM)	7,700LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>82
Beam Angle	100D
Lamp Efficacy (LM/W)	100LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	461*377*332
IP Rating	65
Operating Temperature	-40 to 55 degC
Housing Material	Aluminum
Certificate	UL, CUL, DLC, Rohs

LED Flood Light 50W AC110-277V 5000K

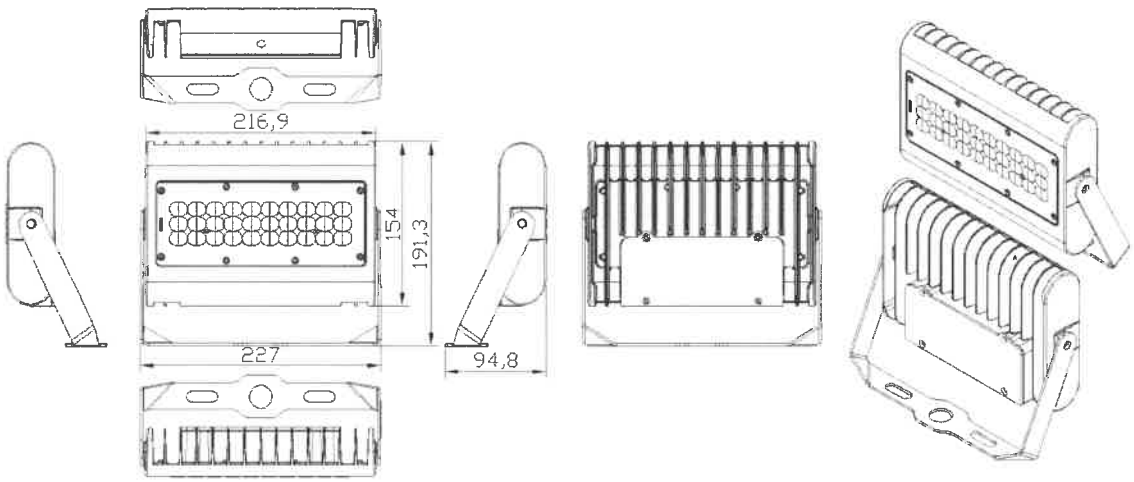
Product description: LED Flood Light 50W AC110-277V 5000K
Model Name: TLFLF50XYYZZ
Order SKU: 700027

◊ Features

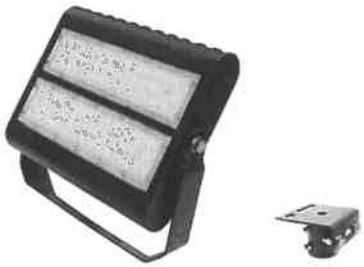
- Energy savings up to 70% vs 175W MH
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Optional slip fitter adapter for easy standard 3.5 IN pole mounting

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	50W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	600mA Max
Power Factor	>0.90
Luminous Flux (LM)	4,731LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>80
Beam Angle	120*90C
Lamp Efficacy (LM/W)	96LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	227*191.3*94.8
IP Rating	65
Operating Temperature	-40 to 55 degC
Material	Aluminum + PC Lens
Certificate	UL, CUL, DLC, Rohs


216,9
154
191,3
227
94,8

LED Flood Light 100W AC110-277V 5000K



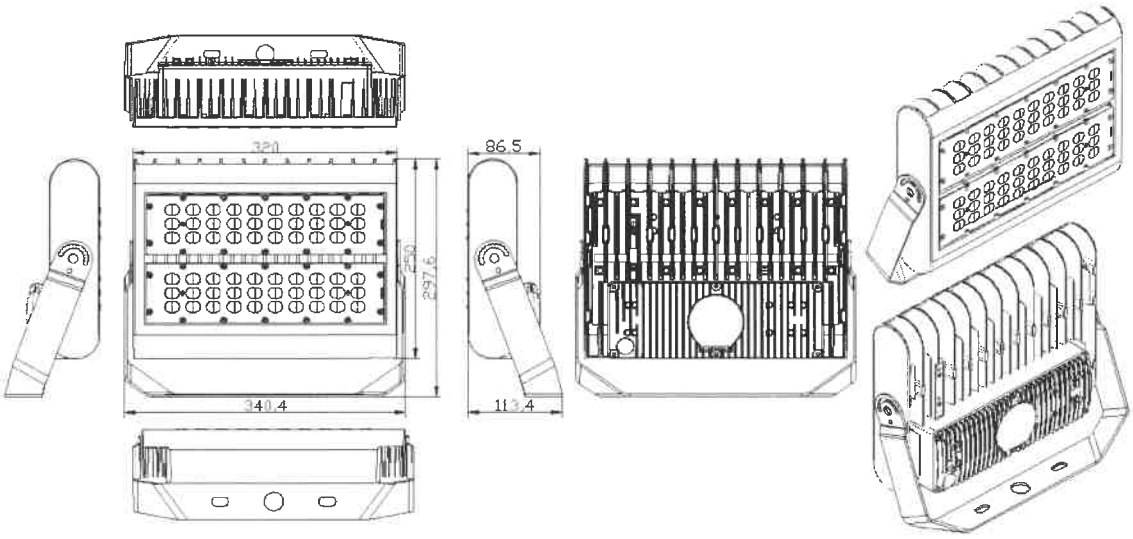
Product description: LED Flood Light 100W AC110-277V 5000K
Model Name: TLFLF100XYYZZ
Order SKU: 700013

◊ Features

- Energy savings up to 70% vs 250W MH
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Optional slip fitter adapter for easy standard 3.5 IN pole mounting

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	100W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	1.2A Max
Power Factor	>0.90
Luminous Flux (LM)	11,021LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>80
Beam Angle	120*90C
Lamp Efficacy (LM/W)	110LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	340.40*297.6*113.4
IP Rating	65
Operating Temperature	-40 to 55 degC
Material	Aluminum + PC Lens
Certificate	UL, CUL, DLC, Rohs


320
86.5
250
297.6
340.4
113.4

LED Flood Light 150W AC110-277V 5000K

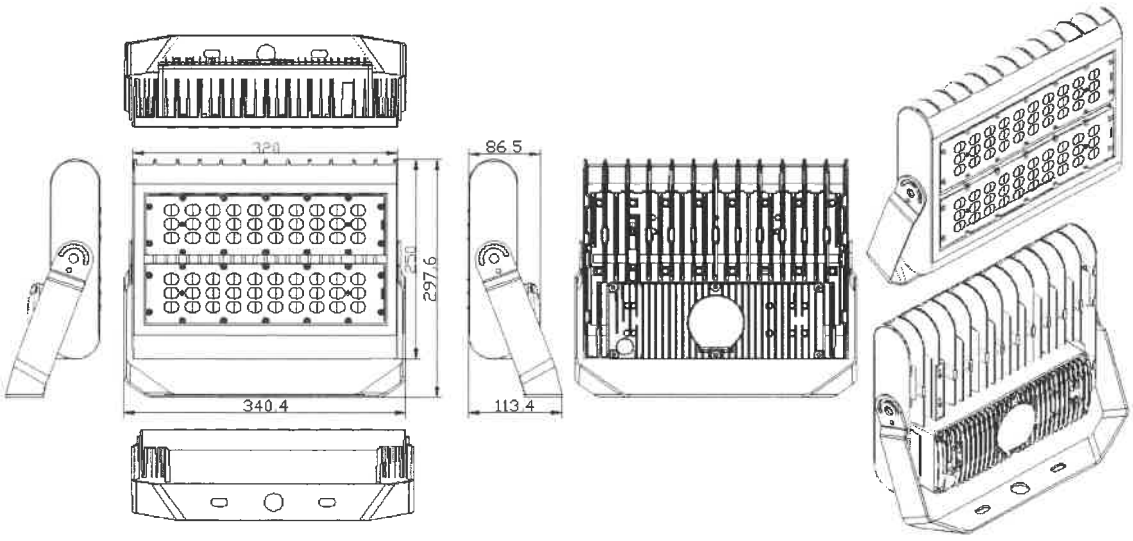
Product description: LED Flood Light 150W AC110-277V 5000K
Model Name: TLFLF150XYYZZ
Order SKU: 700031

◊ Features

- Energy savings up to 70% vs 400W MH
- Sealed die-casting profile for outdoor applications
- High quality of heat-resisting polycarbonate optical lens
- Optional slip fitter adapter for easy standard 3.5 IN pole mounting

◊ Specifications

Rated Voltage (V)	120-277V
Rated Wattage (W)	150W
Frequency (Hz)	50/60 Hz
Rated Input Current (mA)	1.8A Max
Power Factor	>0.90
Luminous Flux (LM)	15,131LM
Color Temperature	Day Light 5000K
Color Rendering Index (Ra)	>80
Beam Angle	120*90C
Lamp Efficacy (LM/W)	110LM/W
Rated Lamp Lifetime (h)	50,000
Dimming	N
Dimension (mm)	340.40*297.6*113.4
IP Rating	65
Operating Temperature	-40 to 55 degC
Material	Aluminum + PC Lens
Certificate	UL, CUL, DLC, Rohs

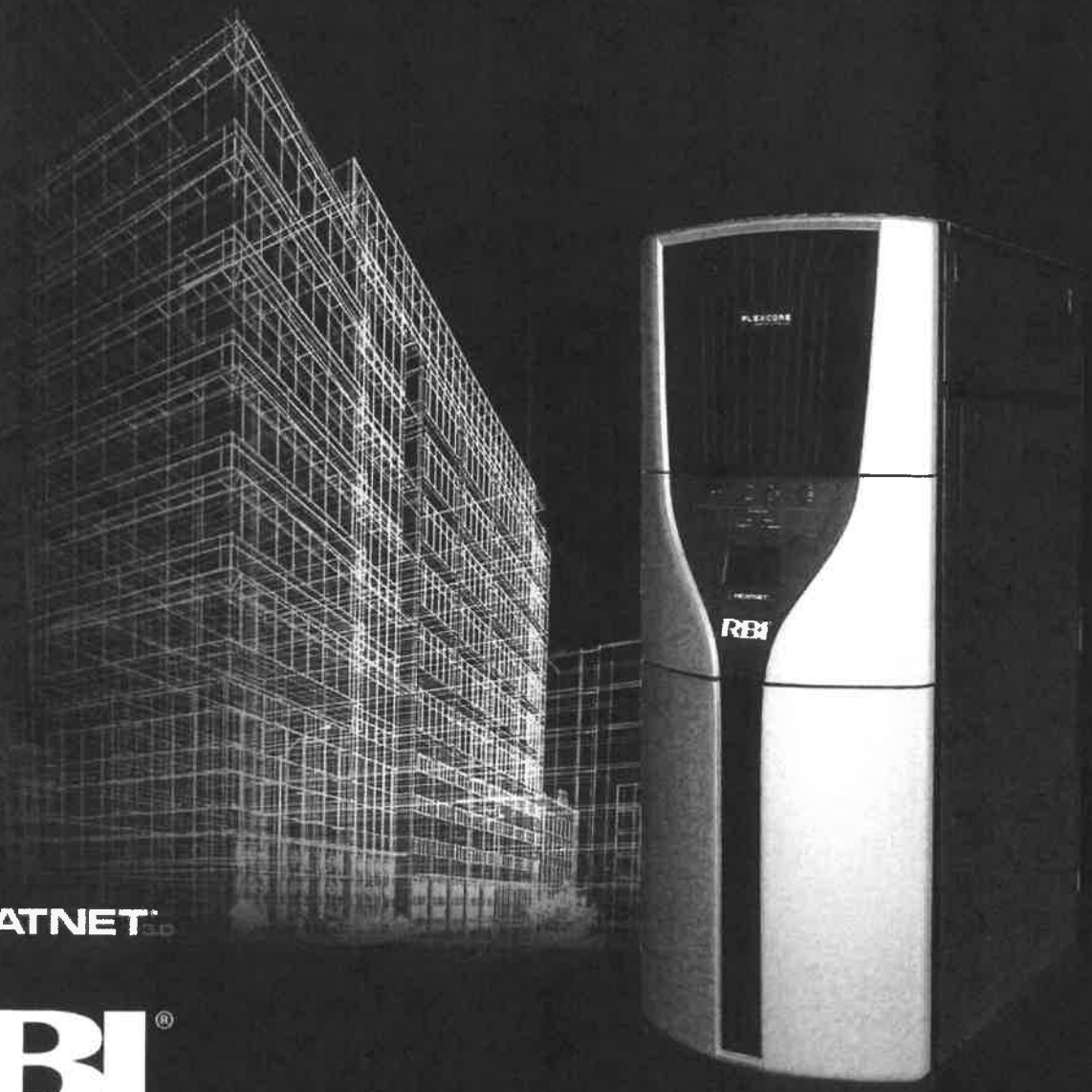

320
86.5
297.6
340.4
113.4

FLEXCORE®

SYMMETRICAL FIRETUBE

CONDENSING BOILER TECHNOLOGY

Bringing firetube hydronic boilers and control technologies to unprecendented levels of performance.



HEATNET

RBI®

RELIABLE. BOLD. INNOVATIVE.

FLEXCORE®
SYMMETRICAL FIRETUBE

FlexCore Symmetrical Firetube boilers bring hydronic heating products to unprecedented levels of operating efficiency.

FlexCore was designed, developed and engineered by the experts at RBI.

Engineered for performance and longevity, FlexCore utilizes a perfectly temperature-balanced heat exchanger that provides not only the highest efficiencies but also a durability beyond that of any competitive firetube boiler on the market.

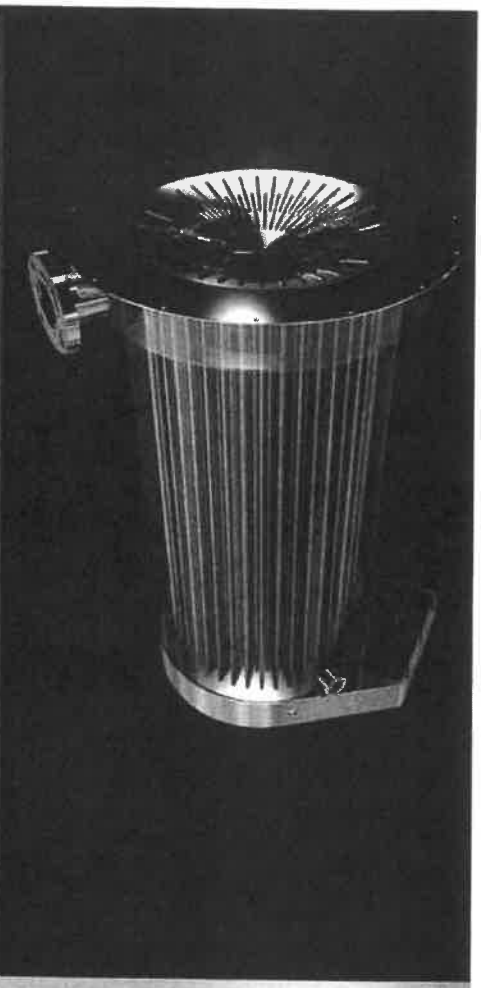
Features and Benefits

- 850 - 6,000 MBH
- 96.8% AHRI Certified
- Up to 99% Maximum Efficiency
- Symmetrical Firetube Heat Exchanger
- Primary/Secondary, Full Flow and Variable Flow Systems
- Full Modulation
- Patented "Turbo Pilot" 8,000 BTU/h Ignition
- HeatNet 3.0 Integrated Control Platform
- Touchscreen Programming & Diagnostics
- Modbus, LonWorks, BACnet BMS Integration
- Low NOx & CO
- Modern Jacket Design
- Premium Efficiency
- Superior Durability
- Easy Installation & Maintenance
- Versatile Footprint Fits Through 36" Door (ALL SIZES)
- PVC & Polypropylene (PP) Vent

AHRI CERTIFIED

All "firetube" boilers are designed to do the same thing: Heat water in an efficient manner.

That is where the comparison ends!



The RBI difference...

FlexCore Symmetrical Firetube boilers are designed for the long haul with no tradeoffs in efficiencies. In order to operate at premium condensing efficiencies many factors come into play that can affect the design, performance and, as importantly, the durability.

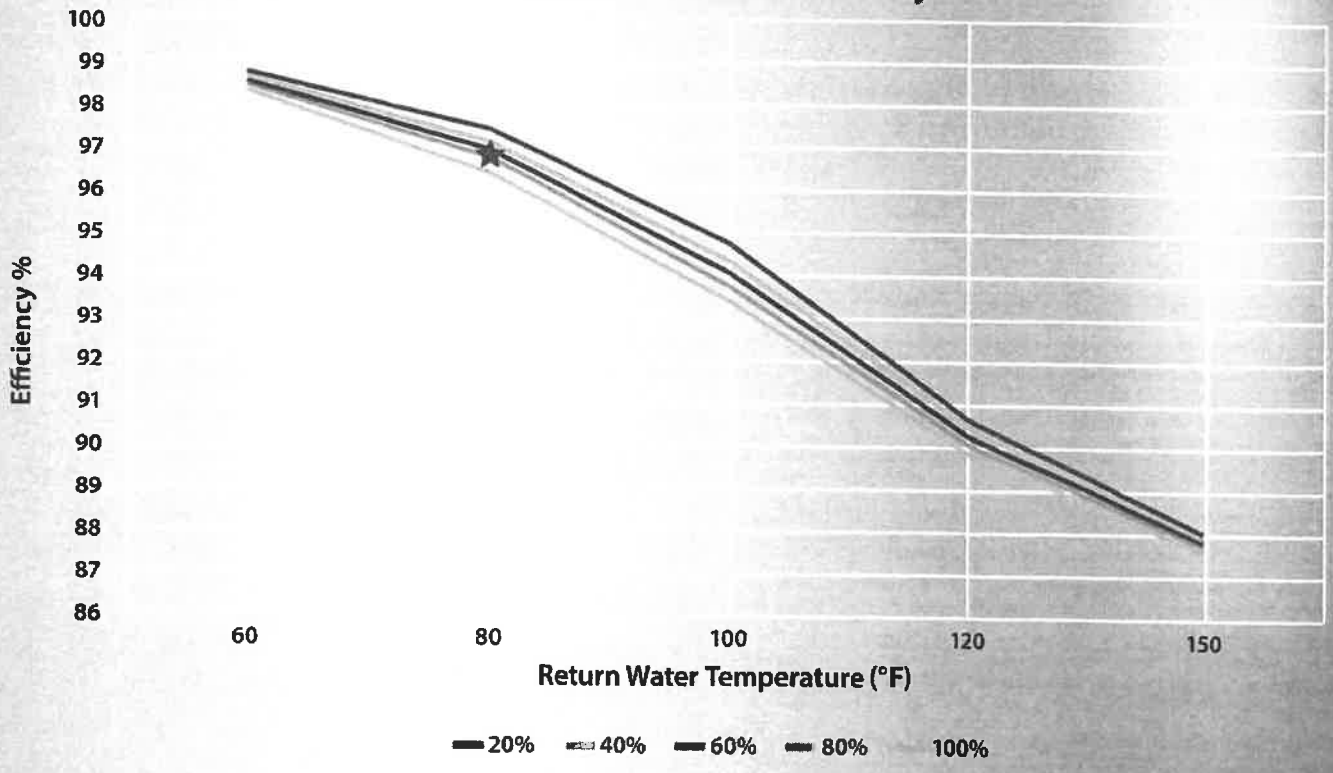
FlexCore is engineered to provide perfect temperature symmetry around an ultra-high efficient core. Flue gas temperatures are even and a consistent temperature rise across all the tubes results in a unrivaled <5° temperature difference across the heat exchanger with NO intra-tubular stresses as seen in many of today's competitive designs.

RBI "flexes" its strength by design. At its core is a piston-like heat exchanger engineered to eliminate the expansion and contraction stresses seen in today's boilers by creating a temperature balanced symmetrical upper tube sheet reminiscent of a diaphragm that absorbs the stresses from this piston-like motion at any water temperature delta.

Condensate is removed through FlexCore's linear design resulting in ultra-high efficiencies in a compact design with minimal corrosive effects.

FlexCore scrubs every last bit of heat from the combustion gases keeping stresses low and efficiencies high at all modulation rates, making FlexCore the most efficient boiler on the market today.

FlexCore Boiler Efficiency

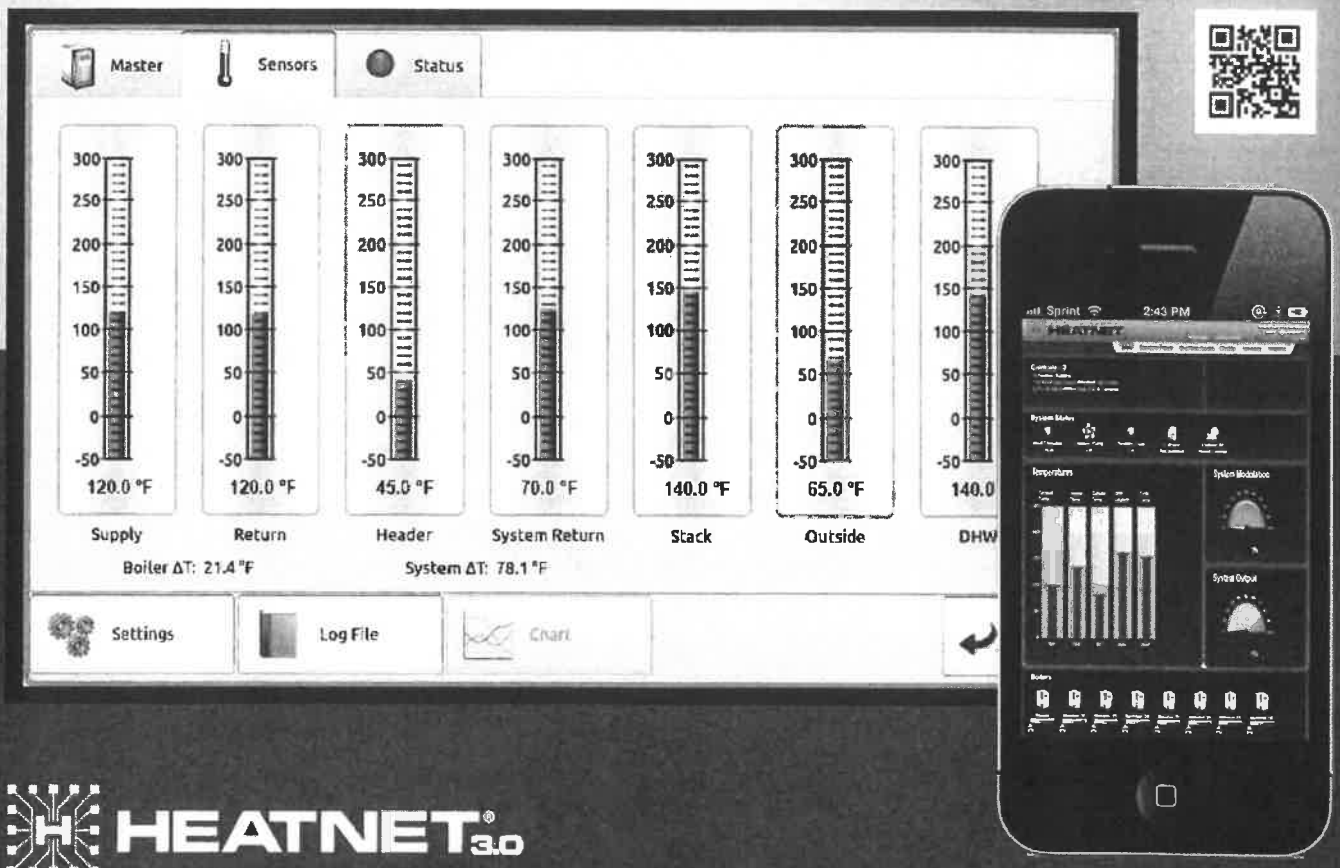


★ **96.8% AHRI Certified Product Performance Thermal Efficiency (CK3000)**

HEATNET® 3.0

Every premium efficiency boiler manufactured by the Mestek Boiler Group is integrated with HeatNet 3.0® – an innovative, digital Boiler Management System that provides consistency and feedback through digital communication. By continuously monitoring several system characteristics, HeatNet 3.0 modulates boiler firing rates to maximize turndown ratios and maintain peak efficiency – no matter the load.

HeatNet 3.0 doesn't just benefit stand-alone boilers; it is a valuable and cost-saving tool in operating a multi-boiler Master/Member network of up to 16 boilers, including mixed-size units. By functioning as a boiler management system, HeatNet 3.0 can incorporate a mixture of condensing boilers and non-condensing boilers to eliminate costly third-party, wall-mounted boiler control platforms.



HEATNET® 3.0

- Digital Touch Screen Programming
- Lead/Lag Cascade (16 Units)
- Mixed-Size Unit Communication
- Adaptive Modulation
- Circular Pump/VFD/Valve Control
- BMS Integration
- Freeze Protection & Delta T Monitoring
- Hybrid/base Load Capability
- Priority Boiler Control
- Domestic Hot Water Communication
- Web-Based Remote Monitoring/Dashboard
- Diagnostics and Troubleshooting
- Set Points
- Exclusive Remote Monitoring Capability with HeatNet Online

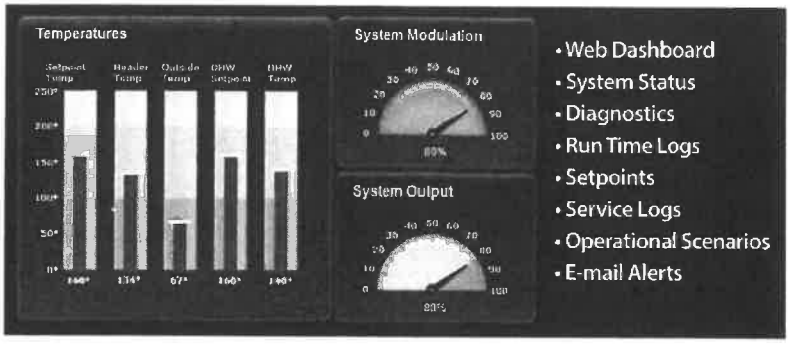
HEATNET® 3.0

HeatNet Online:
Remote Monitoring, Boiler Performance Control & System Protection

HeatNet Online allows for real-time remote monitoring of boiler temperatures, limit circuit inputs, diagnostics and overall system performance.

HeatNet Online is a completely secure web-based monitoring program that allows visual boiler feedback from anywhere through an easy-to-read dashboard. View boiler set points, service logs and system issues from your office computer, tablet or cell phone.

HeatNet Online sends email text alerts for out-of-specification operation allowing for proactive responses to potentially harmful situations protecting the equipment and your investment.



Building Dashboard
- Supports Multiple Systems
- "Live" Data Updated Every 60 Seconds
- Setpoint, Header, DHW Set, DHW (if enabled) Stack (if detected)
- System Modulation, System Output
- Visual Cues for Firing Boilers

System History
- Visual Trending
  - Header Temp
  - Modulation
  - DHW Temp
  - Setpoints (Operating, DHW)
- "Zoom" Charting Scales from Hour to Minute Interval
- Log Entries
  - Full Log Event
    - Event Description
    - System Detail
  - No 1000 Log Limit

Service Log History
- Individual Entries Can Be Stand Alone or Attached to Warnings, Faults
- File Upload
  - Allows Technicians to Upload Pictures From Phone
- Dynamic Link
  - Links to Product Specific Support Literature

RBI® RELIABLE. BOLD. INNOVATIVE.

The Turbo Pilot®, Rugged & Reliable

Another investment in the reliable performance that's built into the FlexCore is its patented Turbo Pilot system. RBI's Turbo Pilot is a industry proven ignition system with 1000's of units installed globally.

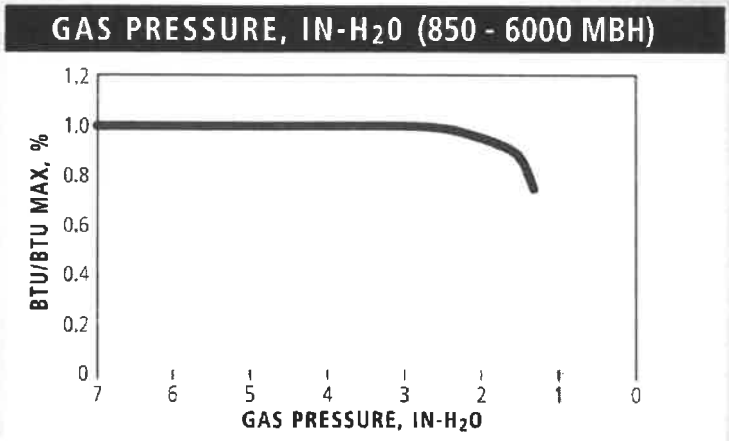
A robust 8,000 BTU/h ignition system, Turbo Pilot is far more reliable and durable than any hot surface ignition and direct spark system. The Turbo Pilot gives burner ignition a surefire, powerful ignition source even in applications with fluctuating gas pressures.

Patented Turbo Pilot 8,000 BTU/h Surefire Ignition System

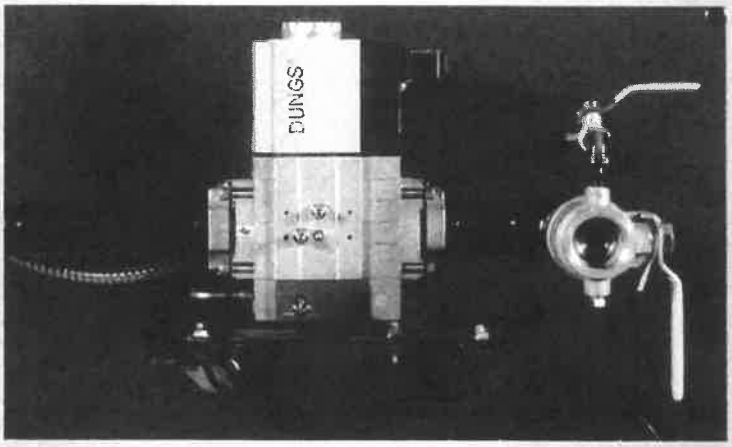
UV detection keeps system diagnostics informed about performance; a technician can also use the observation port to confirm spark/flame without removing the pilot or burner assembly.

Increase Efficiency Without Compromise

RBI's state-of-the-art air/fuel coupling combustion control system is instantly responsive and completely adaptable. This unique boiler combustion control system is designed to keep the FlexCore running safe, clean and efficient. The system reacts to changes in air and instantly compensates fuel supply by adjusting input to maintain a constant air/fuel mixture across the modulation range. The unique design of the air/fuel mixing system ensures a complete and consistent air/fuel mixture to the burner which increase combustion efficiency and repeatability all while maintaining low emissions.



FlexCore units are capable of full-fire output at a minimum of 3" wc.



Advanced gas train design monitors and regulates gas input based on combustion air pressure, which in turn provides highly repeatable air/fuel ratio throughout the operating range.

FLEXCORE® SYMMETRICAL FIRETUBE

FlexCore Boiler Product Specifications
CK850-CK6000

	CK0850	CK1000	CK1500	CK2000	CK2500	CK3000	CK3500	CK4000	CK4500	CK5000	CK6000
Boiler Ratings and Capacities											
Input BTU/HR	850,000	1,000,000	1,500,000	1,999,000	2,500,000	3,000,000	3,499,000	3,998,000	4,500,000	5,000,000	6,000,000
Output BTU/HR (High Fire)	811,750	955,000	1,426,500	1,901,049	2,397,500	2,904,000	3,327,549	3,802,098	4,329,000	4,795,000	5,808,000
AHRI Thermal Efficiency (%)	95.5	95.5	95.1	95.1	95.9	96.8	95.1	95.1	96.2	95.9	96.8
Turn Down	5:1	5:1	5:1	5:1	5:1	5:1	5:1	5:1	5:1	5:1	5:1
Boiler HP	24.3	28.5	42.6	56.8	71.6	86.8	99.4	113.6	129.3	143.2	173.5
Fuel Type	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas	Nat Gas
Category	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV	CAT II/IV
Water Volume (gal)	42	42	40	62	58	56	102	124	96	116	112
Design Data - (Max working Press)	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig	160 psig
ASME Sect IV Fireside Htg Surface	82	82	124	168	202	235	292	336	359	404	470
ASME Sect IV Waterside Htg Surface	85	85	132	174	211	244	306	348	376	422	488
Cv GPM (1PSIG)	87	87	85	93	100	132	165	168	155	166	178
Electrical (Standard)	120V - 1ph	120V - 1ph	230V - 1ph	230V - 1ph	230V - 3ph	230V - 3ph	230V - 3ph	230V - 3ph	230V - 3ph	230V - 3ph	230V - 3ph
Electrical (Optional - 3ph)	N/A	N/A	208V-575V	208-575V	208-575V	208-575V	208-575V	208-575V	208-575V	208-575V	208-575V
Boiler FLA (amps)	9.5	9.5	12.7	12.7	10.3	10.3	20.6	20.6	20.6	20.6	20.6
Min. Gas Pressure (w.c.)	3	3	3	3	3	3	3	3	3	3	3
Max. Gas Pressure (w.c.)	14	14	14	14	14	14	14	14	14	14	14
Boiler Temp Rise/Press Drop											
Max. Flow Rate (gpm) @ 20 delta t (f)	81.2	95.5	142.7	190.2	239.8	290.5	332.9	380.4	433.1	479.7	581
Min. Flow Rate (gpm) @ 100 delta t (f)	16.2	19.1	28.5	38	48	58.1	66.6	76.1	86.6	95.9	116.2
40°F - delta t (Flow Rate, gpm)	40.6	47.8	71.4	95.1	119.9	145.3	166.4	158.3	216.5	239.8	290.5
Pressure drop (ft-hd)	0.5	0.7	1.6	2.4	3.3	2.8	2.3	2	4.5	4.8	6.1
60°F - delta t (Flow Rate, gpm)	27.1	31.8	47.6	63.4	79.9	96.8	111	126.8	144.4	159.9	193.7
Pressure drop (ft-hd)	0.2	0.3	0.7	1.1	1.5	1.2	1	1.3	2	2.1	2.7
80°F - delta t (Flow Rate, gpm)	20.3	23.9	35.7	47.5	60	72.6	83.2	95.1	108.3	119.9	145.3
Pressure drop (ft-hd)	0.1	0.2	0.4	0.6	0.8	0.7	0.6	0.7	1.1	1.2	1.5
Max Vent (Equiv. ft)	100	100	100	100	100	100	100	100	100	100	100
Max Combustion Air (Equiv. ft)	100	100	100	100	100	100	100	100	100	100	100
Boiler Trim											
Number of Relief Valves	1	1	1	1	1	1	2	2	2	2	2
Relief Valve Pressure Rating (PSI)	50	50	50	50	50	50	50	50	50	50	50
Inlet Water Connection (in)	3	3	3	3	3	3	4	4	4	4	4
Outlet Water Connection (in)	3	3	3	3	3	3	4	4	4	4	4
Gas Connection (in)	1	1	1-1/2	1-1/2	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
Vent Outlet Connection (in)	5	5	6	6	8	8	10	10	10	12	12
Vent Material	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS
Combustion Air Connection	6	6	8	8	8	8	10	10	10	12	12
Dimensions											
Height (in)	80	80	80	80	80	80	80	80	80	80	80
Width (in)	32	32	32	32	32	32	34	34	34	34	34
Depth (in)	70	70	70	72.4	72.4	72.4	109.4	109.4	109.4	109.4	109.4
Operating Weight (lbs.)	1655	1725	1780	2290	2340	2425	4070	4580	4200	4685	4885
Shipping Weight (lbs.)	1515	1515	1555	1880	1955	2055	3420	3745	3600	3920	4150
Clearance Service/Combustible											
Front (in)	36/6	36/6	36/6	36/6	36/6	36/6	36/6	36/6	36/6	36/6	36/6
Rear (in)	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6
Right Side (in)	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6
Left Side (in)	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6	24/6
Top (in)	30/6	30/6	30/6	30/6	30/6	30/6	30/6	30/6	30/6	30/6	30/6

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www.rbiwaterheaters.com

A MESTEK COMPANY

YORK Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Village of Lancaster Quote 08112017**

Unit Model #: **ZJ049N12B2B1AAA1A1**

Quantity: **2** Tag #: **4 Ton**

System: **ZJ049N12B2B1AAA1A1 (2)**

Cooling Performance

Total gross capacity	53.3 MBH
Sensible gross capacity	38.4 MBH
Total net capacity	51.1 MBH
Sensible net capacity	36.2 MBH
Seasonal Efficiency (at ARI)	15.00 SEER
Efficiency (at ARI)	12.20 EER
Ambient DB temp.	86.5 °F
Entering DB temp.	80.0 °F
Entering WB temp.	67.0 °F
Leaving DB temp.	57.8 °F
Leaving WB temp.	56.3 °F
Power input (w/o blower)	3.20 kW
Sound power	80 dB(A)

Refrigerant

Refrigerant type	R-410A
Sys1	7 lbs 8 oz

Gas Heating Performance

Entering DB temp.	60 °F
Heating output capacity (Max)	97 MBH
Supply air	1600 CFM
Heating input capacity (Max)	120 MBH
Leaving DB temp.	116.1 °F
Air temp. rise	56.1 °F
SSE	81.0 %
Stages	2

Supply Air Blower Performance

Supply air	1600 CFM
Ext. static pressure	0.6 IWG
Addl. Unit Losses (Options/Accessories)	0.14 IWG
Blower speed	868 RPM
Max BHP of Motor (including service factor)	1.73 HP
Duct location	Bottom
Motor rating	1.50 HP
Actual required BHP	0.69 HP
Power input	0.64 kW
Elevation	705 ft.
Drive type	BELT

Electrical Data

Power supply	230-3-60
Unit min circuit ampacity	21.3 Amps
Unit max over-current protection	30 Amps

Dimensions & Weight

Hgt	42 in.	Len	89 in.	Wth	59 in.
Weight with factory installed options					960 lbs.

Clearances

Right	12 in.	Front	36 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.

Note: Please refer to the tech guide for listed maximum static pressures

4 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Single Stage Cooling
- 120 MBH Input Aluminized Steel, Two Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Reciprocating Compressor
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- Slide-Out Blower/1.5 HP Belt Drive Motor Assembly
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 16"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Through-the-Curb and Through-the-Base Utility Connections
- Single Point Power Connection
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

BAS Controller

- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: Village of Lancaster Quote 08112017

Quantity: 2 **Tag #:** 4 Ton

Unit Model #: ZJ049N12B2B1AAA1A1

System: ZJ049N12B2B1AAA1A1 (2)

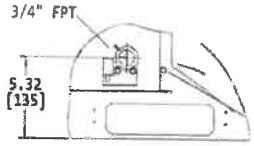
Consolidated Drawing

NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   - RIGHT SIDE: 12 [305]
   - LEFT SIDE: 36 [915]
   - FRONT: 36 [915]
   - REAR: 36 [915]
   - TOP: 72 [1830]
   - BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.
11. 8 TUBE HEAT EXCHANGER IS NOT AVAILABLE FOR 3 & 4 TON UNITS.

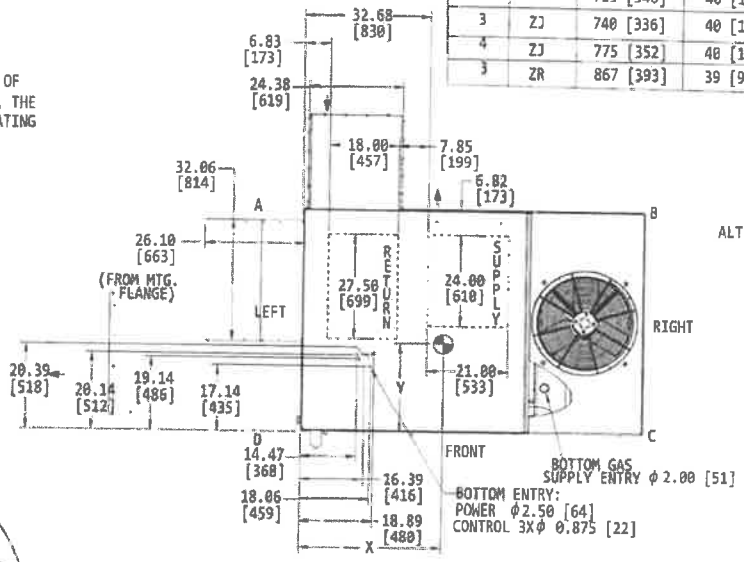
TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
3	ZH	723 [328]	40 [1016]	26 [660]	175 [79]	143 [65]	182 [83]	223 [101]
4	ZH	763 [346]	40 [1016]	26 [660]	185 [84]	151 [69]	192 [87]	235 [107]
3	ZJ	740 [336]	40 [1016]	26 [660]	180 [82]	147 [67]	186 [84]	228 [103]
4	ZJ	775 [352]	40 [1016]	26 [660]	174 [79]	142 [65]	207 [94]	253 [115]
3	ZR	867 [393]	39 [991]	24 [610]	215 [98]	167 [76]	212 [96]	272 [123]

DIRECTION OF AIRFLOW

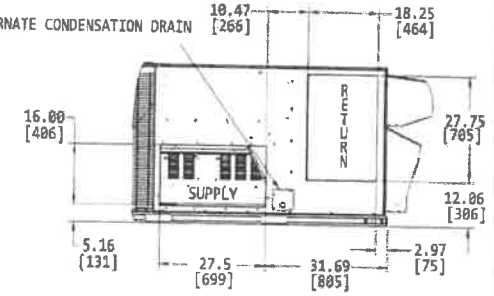
CENTER OF GRAVITY



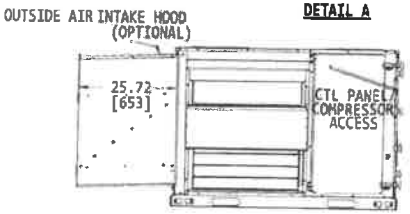
DETAIL A



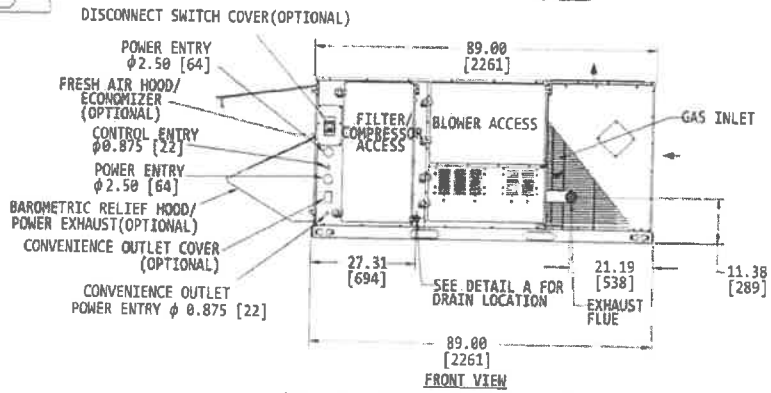
TOP VIEW



REAR (PARTIAL VIEW)
(INTAKE HOOD NOT SHOWN IN THIS VIEW)

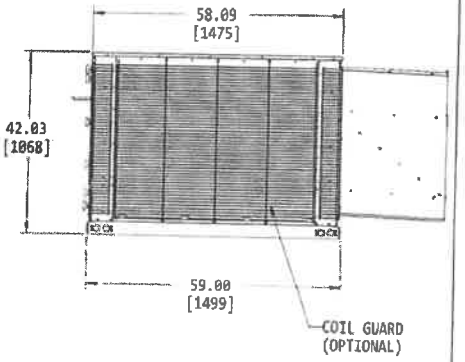


LEFT VIEW



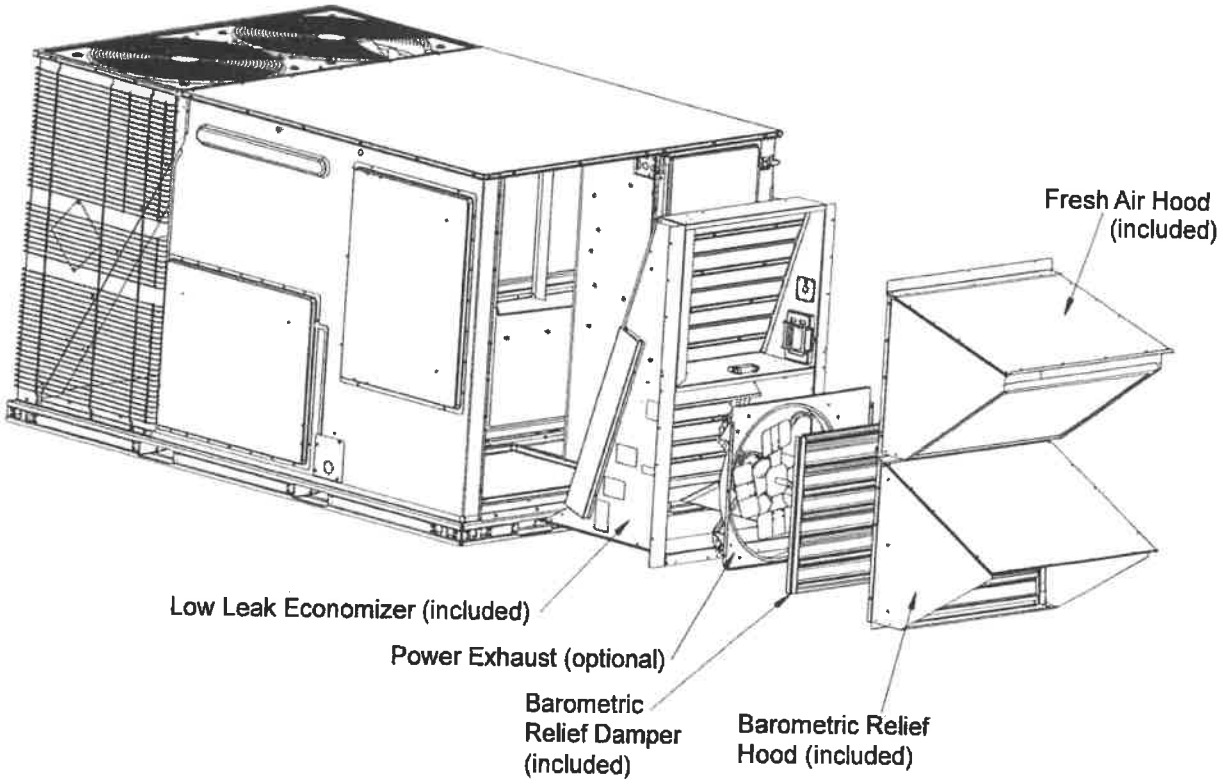
FRONT VIEW

(OPTIONAL FRONT COIL GUARD NOT SHOWN IN THIS VIEW)



RIGHT VIEW

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

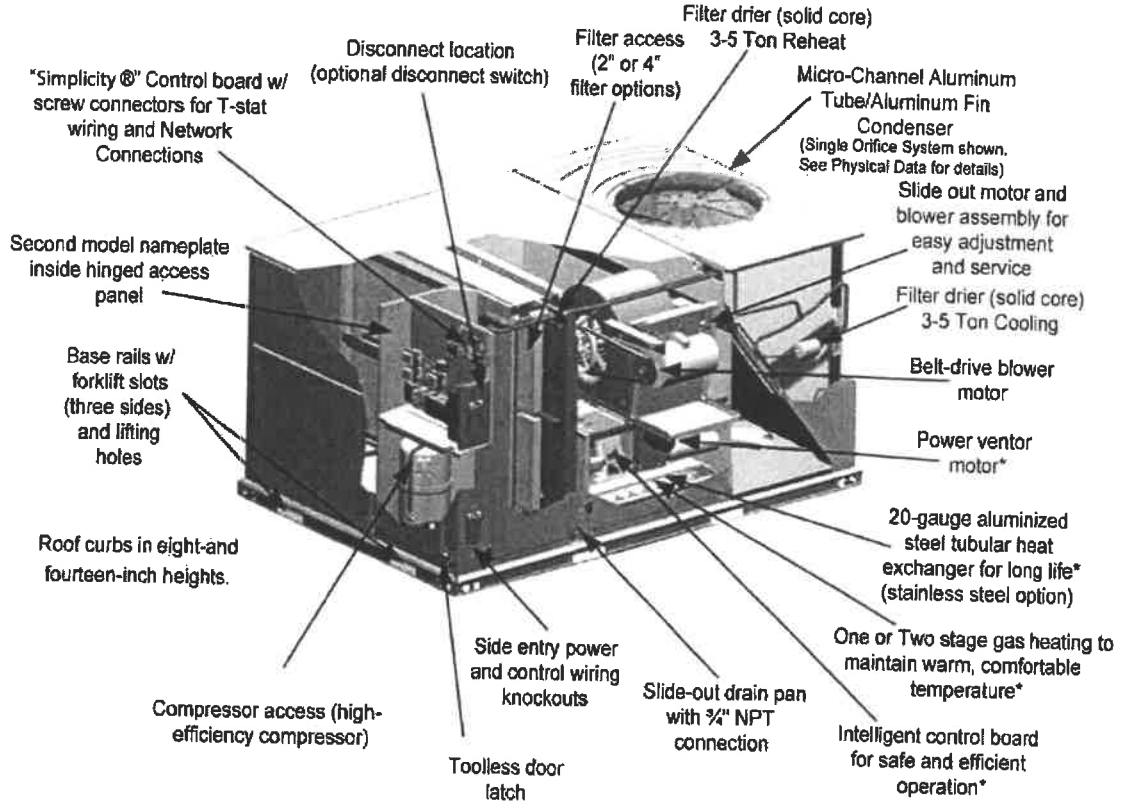
The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Village of Lancaster Quote 08112017**
Unit Model #: **ZJ049N12B2B1AAA1A1**
Quantity: **2** Tag #: **4 Ton**
System: **ZJ049N12B2B1AAA1A1 (2)**

Component Locations

3 Through 5 Ton



*Available on Gas Units Only

YORK® Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Village of Lancaster Quote 08112017**

Quantity: **1** Tag #: **3 Ton**

Unit Model #: **ZJ037N12B2B1AAA1A1**

System: **ZJ037N12B2B1AAA1A1**

Cooling Performance	
Total gross capacity	40.0 MBH
Sensible gross capacity	28.2 MBH
Total net capacity	38.5 MBH
Sensible net capacity	26.7 MBH
Seasonal Efficiency (at ARI)	14.50 SEER
Efficiency (at ARI)	12.20 EER
Ambient DB temp.	86.5 °F
Entering DB temp.	80.0 °F
Entering WB temp.	67.0 °F
Leaving DB temp.	58.3 °F
Leaving WB temp.	56.4 °F
Power input (w/o blower)	2.26 kW
Sound power	77 dB(A)

Refrigerant	
Refrigerant type	R-410A
Sys1	6 lbs 12 oz

Gas Heating Performance	
Entering DB temp.	60 °F
Heating output capacity (Max)	97 MBH
Supply air	1200 CFM
Heating input capacity (Max)	120 MBH
Leaving DB temp.	134.8 °F
Air temp. rise	74.8 °F
SSE	81.0 %
Stages	2

Supply Air Blower Performance	
Supply air	1200 CFM
Ext. static pressure	0.6 IWG
Blower speed	784 RPM
Max BHP of Motor (including service factor)	1.73 HP
Duct location	Bottom
Motor rating	1.50 HP
Actual required BHP	0.49 HP
Power input	0.45 kW
Elevation	705 ft.
Drive type	BELT

Electrical Data	
Power supply	230-3-60
Unit min circuit ampacity	18.2 Amps
Unit max over-current protection	25 Amps

Dimensions & Weight					
Hgt	42 in.	Len	89 in.	Wth	59 in.
Weight with factory installed options					925 lbs.

Clearances					
Right	12 in.	Front	36 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.

Note: Please refer to the tech guide for listed maximum static pressures

3 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Single Stage Cooling
- 120 MBH Input Aluminized Steel, Two Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Reciprocating Compressor
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- Slide-Out Blower/1.5 HP Belt Drive Motor Assembly
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 16"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Through-the-Curb and Through-the-Base Utility Connections
- Single Point Power Connection
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

BAS Controller

- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Village of Lancaster Quote 08112017**

Quantity: **1** Tag #: **3 Ton**

Unit Model #: **ZJ037N12B2B1AAA1A1**

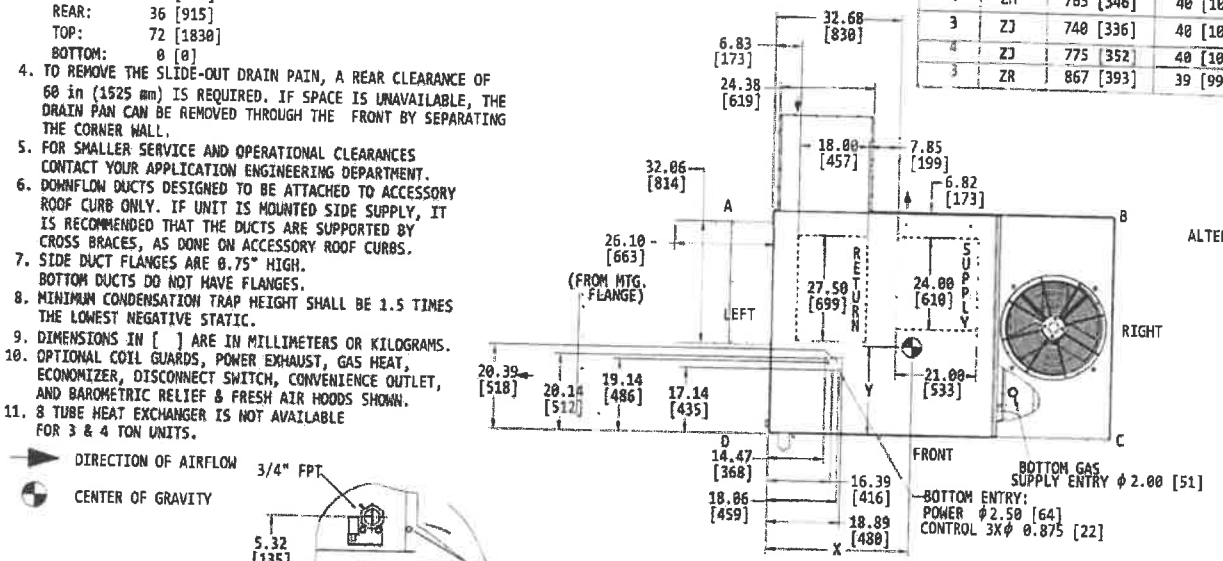
System: **ZJ037N12B2B1AAA1A1**

Consolidated Drawing

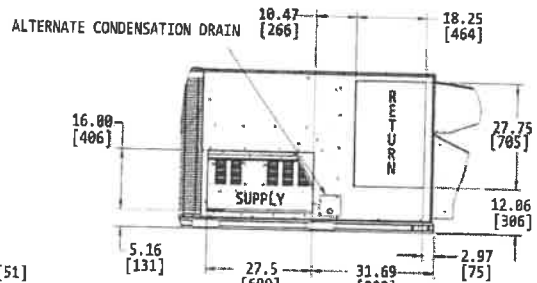
NOTES:

1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   - RIGHT SIDE: 12 [305]
   - LEFT SIDE: 36 [915]
   - FRONT: 36 [915]
   - REAR: 36 [915]
   - TOP: 72 [1830]
   - BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.
11. 8 TUBE HEAT EXCHANGER IS NOT AVAILABLE FOR 3 & 4 TON UNITS.

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
3	ZH	723 [328]	40 [1016]	26 [660]	175 [79]	143 [65]	182 [83]	223 [101]
4	ZH	763 [346]	40 [1016]	26 [660]	185 [84]	151 [69]	192 [87]	235 [107]
3	ZJ	740 [336]	40 [1016]	26 [660]	180 [82]	147 [67]	186 [84]	228 [103]
4	ZJ	775 [352]	40 [1016]	26 [660]	174 [79]	142 [65]	207 [94]	253 [115]
5	ZR	867 [393]	39 [991]	24 [610]	215 [98]	167 [76]	212 [96]	272 [123]

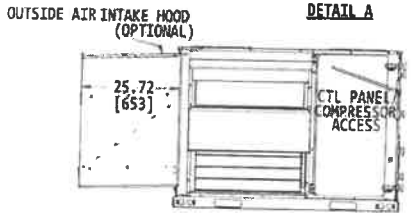


TOP VIEW

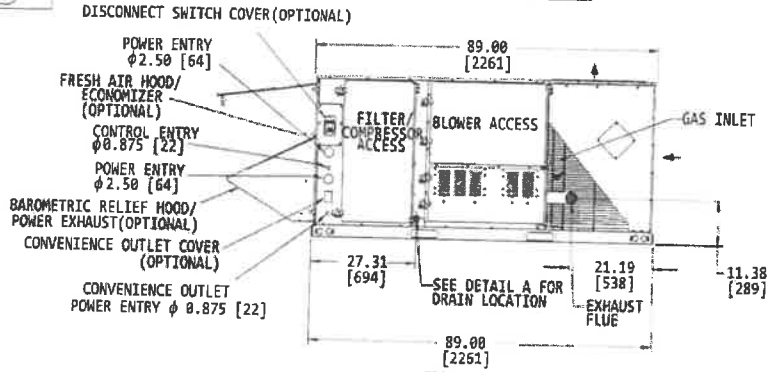


REAR (PARTIAL VIEW)
(INTAKE HOOD NOT SHOWN IN THIS VIEW)

DETAIL A

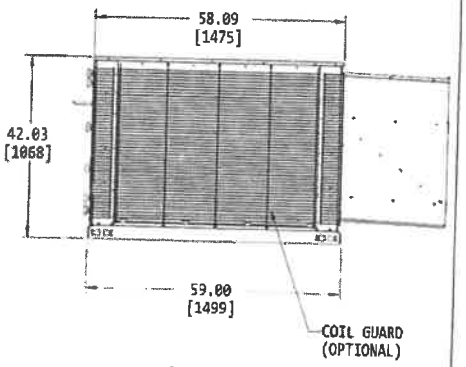


LEFT VIEW



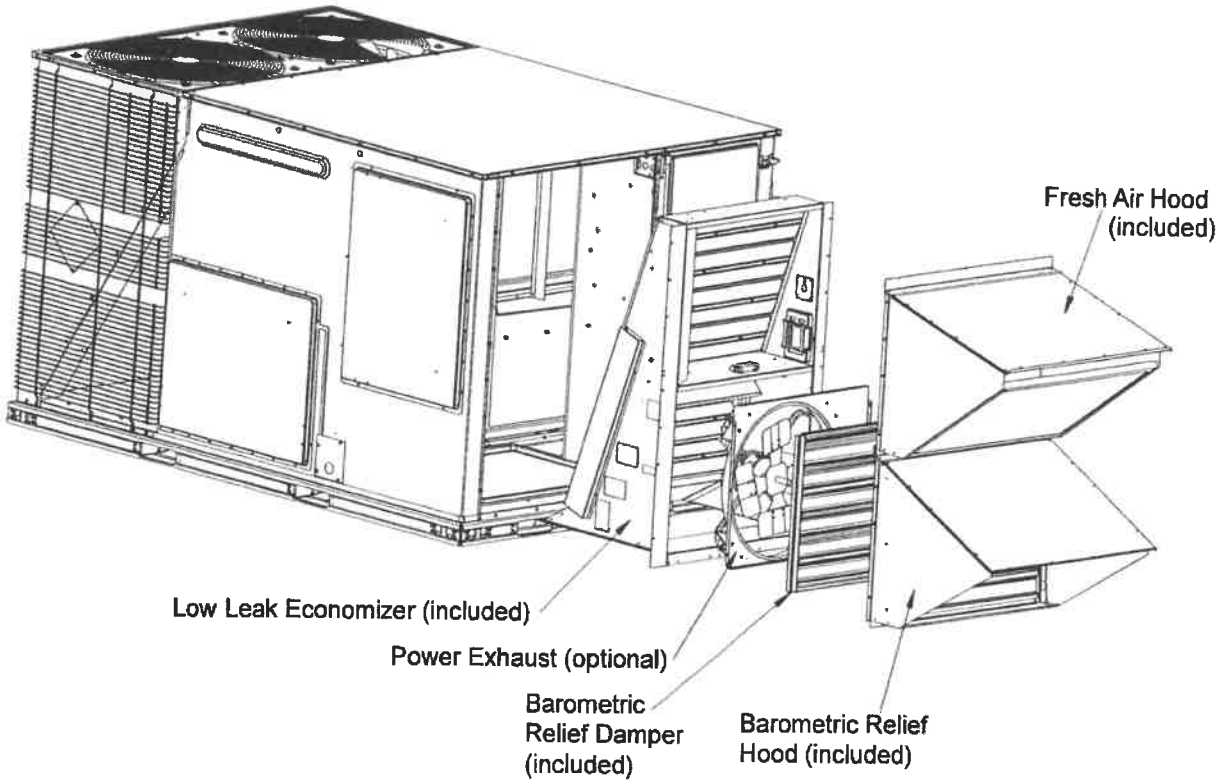
FRONT VIEW

(OPTIONAL FRONT COIL GUARD NOT SHOWN IN THIS VIEW)



RIGHT VIEW

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

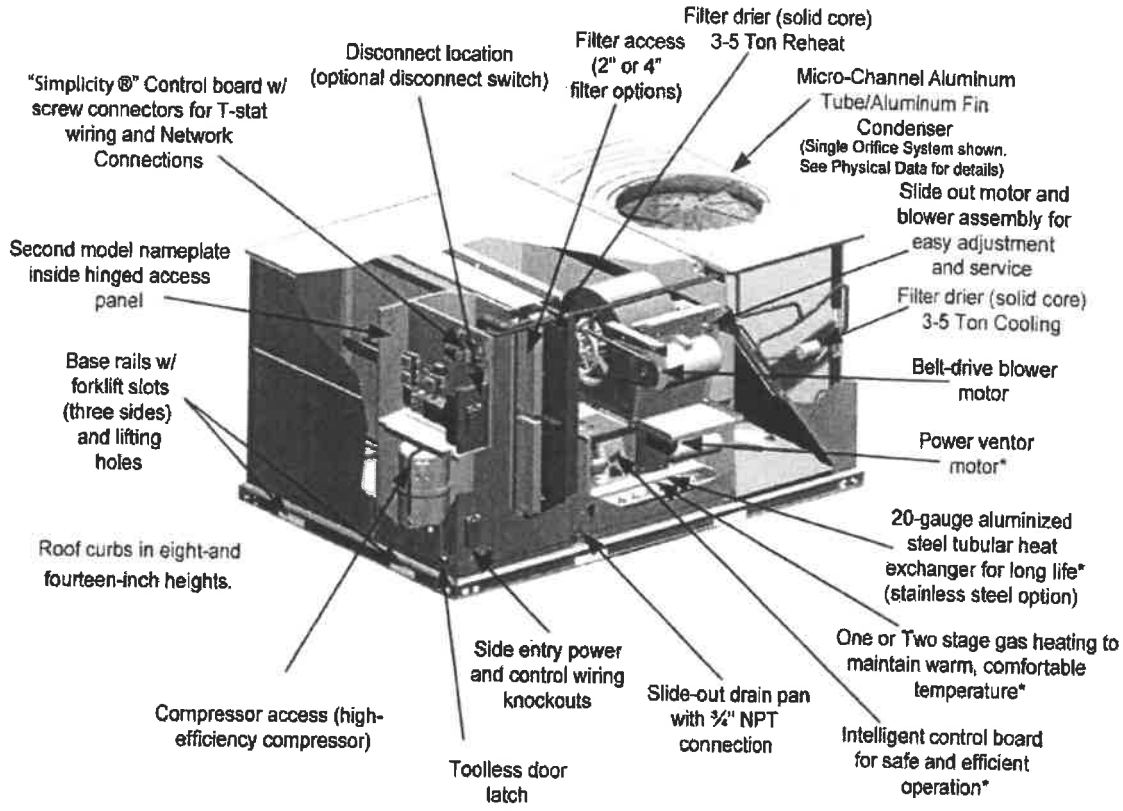
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Village of Lancaster Quote 08112017** Unit Model #: **ZJ037N12B2B1AAA1A1**

Quantity: **1** Tag #: **3 Ton** System: **ZJ037N12B2B1AAA1A1**

Component Locations

3 Through 5 Ton



*Available on Gas Units Only

YORK® Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017** | Unit Model #: **ZJ061H12B4B1AAA1A1**

Quantity: **2** Tag #: **5 Ton** | System: **ZJ061H12B4B1AAA1A1 (2)**

Cooling Performance		
Total gross capacity	66.8	MBH
Sensible gross capacity	48.1	MBH
Total net capacity	63.8	MBH
Sensible net capacity	45.1	MBH
Seasonal Efficiency (at ARI)	15.00	SEER
Efficiency (at ARI)	12.20	EER
Ambient DB temp.	86.5	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	57.7	°F
Leaving WB temp.	56.3	°F
Power input (w/o blower)	3.73	kW
Sound power	84	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	8 lbs	4 oz

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	97	MBH
Supply air	2000	CFM
Heating input capacity (Max)	120	MBH
Leaving DB temp.	104.9	°F
Air temp. rise	44.9	°F
SSE	81.0	%
Stages	1	

Supply Air Blower Performance		
Supply air	2000	CFM
Ext. static pressure	0.6	IWG
Addl. Unit Losses (Options/Accessories)	0.18	IWG
Blower speed	952	RPM
Max BHP of Motor (including service factor)	1.73	HP
Duct location	Bottom	
Motor rating	1.50	HP
Actual required BHP	0.93	HP
Power input	0.87	kW
Elevation	705	ft.
Drive type	BELT	

Electrical Data		
Power supply	460-3-60	
Unit min circuit ampacity	14.7	Amps
Unit max over-current protection	20	Amps

Dimensions & Weight					
Hgt	42 in.	Len	89 in.	Wth	59 in.
Weight with factory installed options					955 lbs.

Clearances					
Right	12 in.	Front	36 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.

Note: Please refer to the tech guide for listed maximum static pressures

5 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Single Stage Cooling
- 120 MBH Input Aluminized Steel, Single Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Reciprocating Compressor
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- 1.5 HP Standard Static Belt Drive Blower
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 16"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Through-the-Curb and Through-the-Base Utility Connections
- Single Point Power Connection
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

BAS Controller

- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017** | Unit Model #: **ZJ061H12B4B1AAA1A1**

Quantity: **2** Tag #: **5 Ton** | System: **ZJ061H12B4B1AAA1A1 (2)**

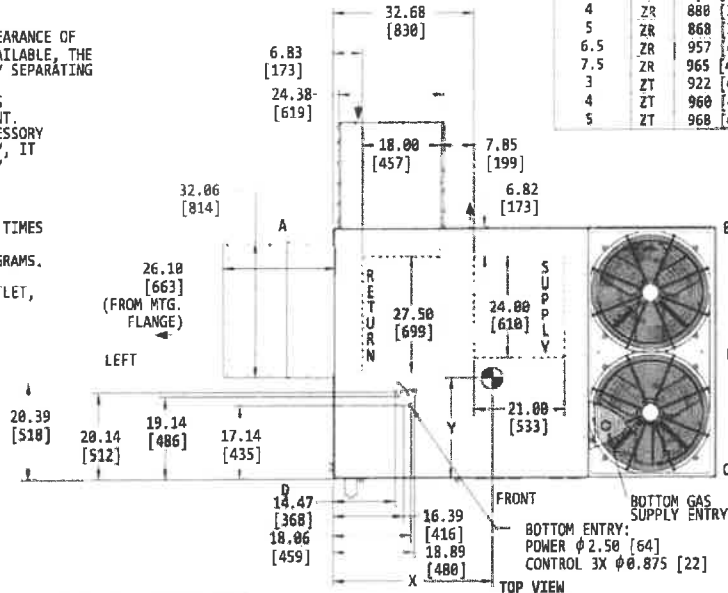
Consolidated Drawing

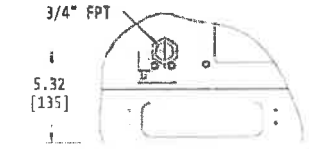
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   - RIGHT SIDE: 12 [305]
   - LEFT SIDE: 36 [915]
   - FRONT: 36 [915]
   - REAR: 36 [915]
   - TOP: 72 [1830]
   - BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAIN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF & FRESH AIR HOODS SHOWN.
11. DELETED
12. 8 TUBE HEAT EXCHANGER IS NOT AVAILABLE FOR 3 & 4 TON UNITS.

DIRECTION OF AIRFLOW

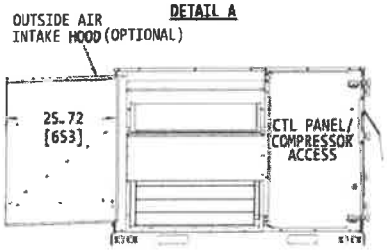
CENTER OF GRAVITY

TONNAGE	UNIT	OPERATING WEIGHT(LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT) X	Y	4 POINT CORNER LOADS (LBS) (BASE UNIT) A	B	C	D
6.5	ZF	860 [390]	38 [965]	24 [610]	200 [91]	149 [68]	218 [99]	292 [133]
7.5	ZF	880 [399]	38 [965]	24 [610]	205 [93]	153 [69]	223 [101]	299 [136]
5	ZH	864 [393]	40 [1016]	26 [660]	210 [95]	171 [78]	217 [99]	266 [121]
6.5 & 7.5	ZH	910 [413]	38 [965]	24 [610]	212 [96]	158 [72]	238 [104]	309 [140]
5	ZJ	770 [349]	40 [1016]	24 [610]	172 [78]	141 [64]	205 [93]	251 [114]
4	ZR	888 [399]	40 [1016]	26 [660]	214 [97]	174 [79]	221 [100]	271 [123]
5	ZR	868 [394]	40 [1016]	26 [660]	211 [96]	172 [78]	218 [99]	267 [121]
6.5	ZR	957 [435]	38 [965]	23 [584]	214 [97]	161 [73]	249 [113]	333 [151]
7.5	ZR	965 [438]	38 [965]	23 [584]	216 [98]	161 [73]	251 [114]	337 [153]
3	ZT	922 [418]	42.4 [1077]	24.7 [627]	202 [92]	184 [84]	255 [116]	281 [128]
4	ZT	960 [436]	42.5 [1080]	25.5 [648]	217 [98]	198 [90]	260 [118]	285 [129]
5	ZT	968 [439]	41.6 [1057]	25.5 [648]	223[101]	196 [89]	257 [117]	293 [133]

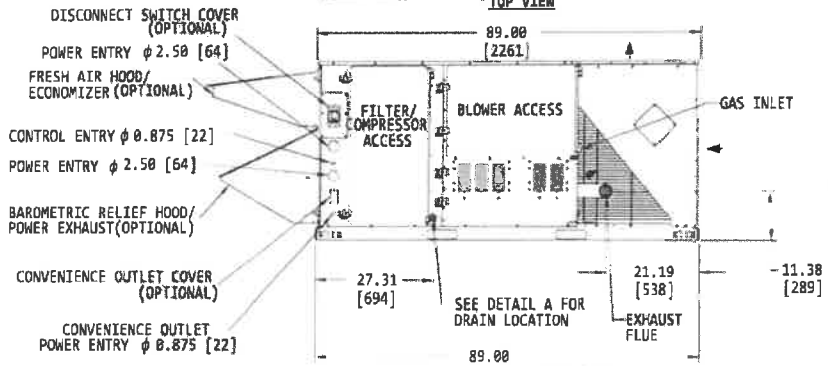


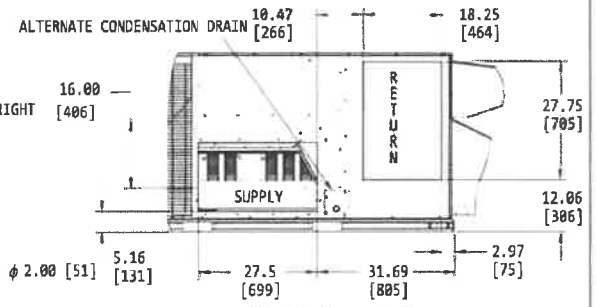


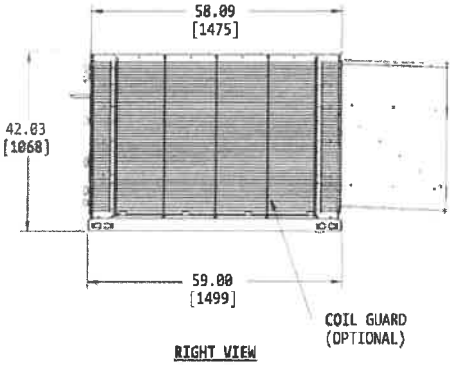
DETAIL A



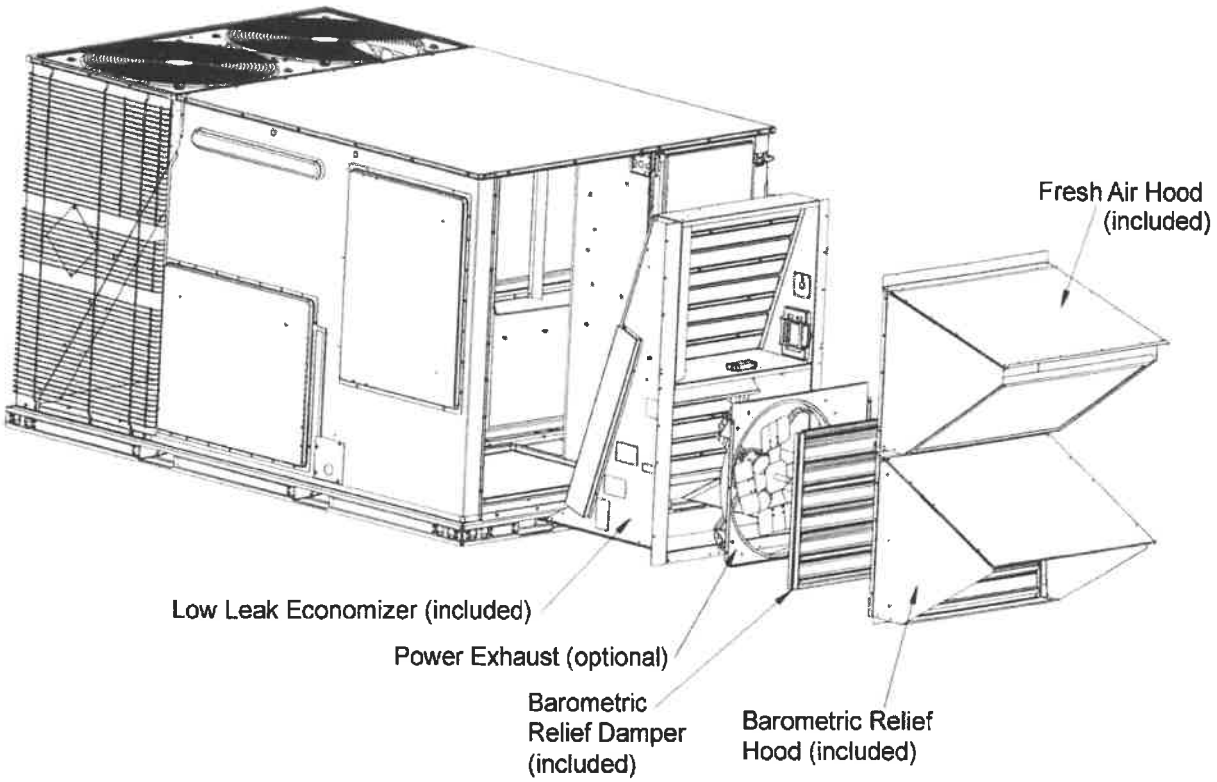
LEFT VIEW







Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

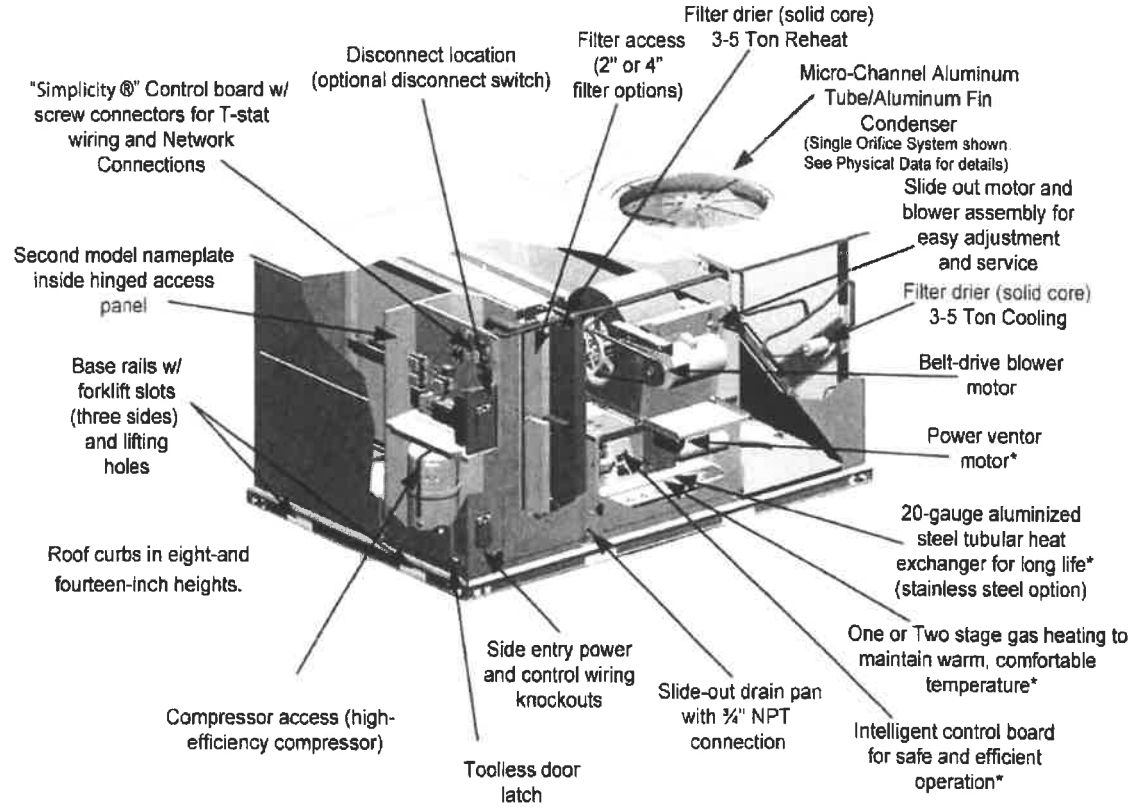
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Dave Nowak RTU Quote 08222017** Unit Model #: **ZJ061H12B4B1AAA1A1**

Quantity: **2** Tag #: **5 Ton** System: **ZJ061H12B4B1AAA1A1 (2)**

Component Locations

3 Through 5 Ton

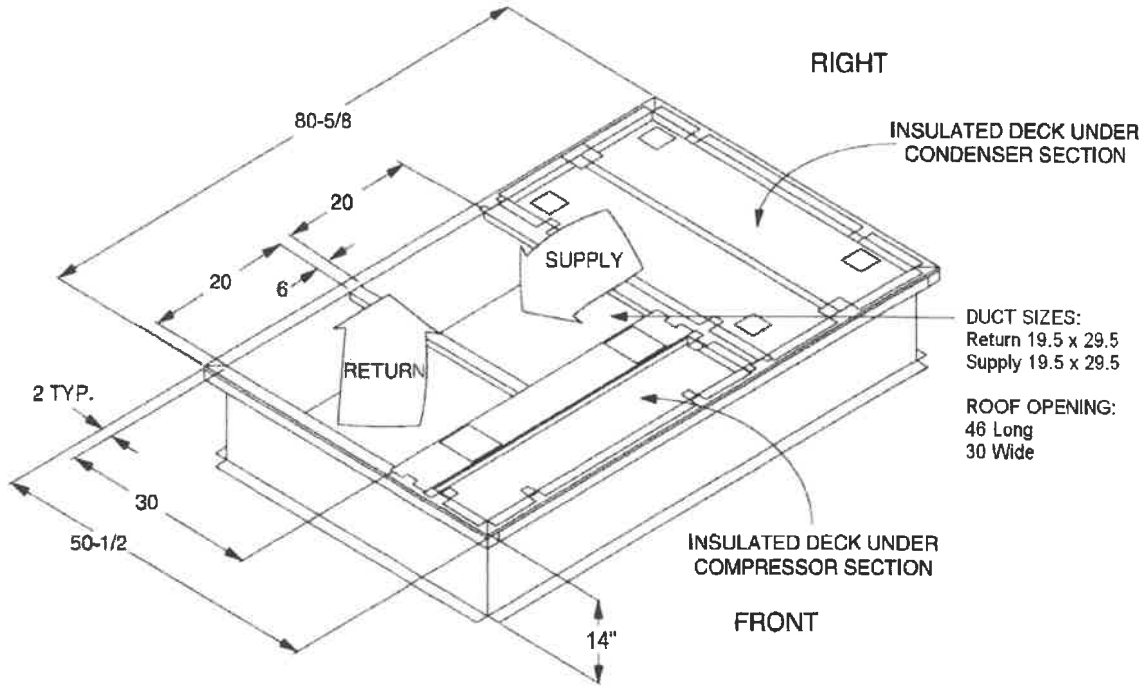


*Available on Gas Units Only

Project Name: **Dave Nowak RTU Quote 08222017** Unit Model #: **ZJ061H12B4B1AAA1A1**

Quantity: **2** Tag #: **5 Ton** System: **ZJ061H12B4B1AAA1A1 (2)**

1RC0471 Roof Curb



* Supply and Return Air (Including duct support rails) as shown, are typical for bottom duct applications.
For location of horizontal duct applications (On rear of unit), refer to Unit Dimensions details.

1RC0471 Roof Curb Dimensions

YORK® Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017** | Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **2** Tag #: **6.5 Ton Horizontal** | System: **ZJ078N18P4B1AAA1A1 (2)**

Cooling Performance		
Total gross capacity	86.1	MBH
Sensible gross capacity	61.4	MBH
Total net capacity	82.8	MBH
Sensible net capacity	58.1	MBH
Efficiency (at ARI)	11.80	EER
Integrated eff. (at ARI)	14.60	IEER
Ambient DB temp.	86.5	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	58.1	°F
Leaving WB temp.	56.4	°F
Power input (w/o blower)	5.18	kW
Sound power	85	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	5 lbs	10 oz
Sys2	5 lbs	12 oz

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	144	MBH
Supply air	2600	CFM
Heating input capacity (Max)	180	MBH
Leaving DB temp.	111.3	°F
Air temp. rise	51.3	°F
SSE	80.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	2600	CFM
Ext. static pressure	0.6	IWG
Addl. Unit Losses (Options/Accessories)	0.14	IWG
Blower speed	766	RPM
Max BHP of Motor (including service factor)	1.73	HP
Duct location	Side	
Motor rating	1.50	HP
Actual required BHP	1.04	HP
Power input	0.97	kW
Elevation	705	ft.
Drive type	BELT	

Electrical Data		
Power supply	460-3-60	
Unit min circuit ampacity	16.1	Amps
Unit max over-current protection	20	Amps

Dimensions & Weight						
Hgt	51	in.	Len	89	in.	Wth	59	in.
Weight with factory installed options							1225	lbs.

Clearances						
Right	12	in.	Front	36	in.	Back	36	in.
Top	72	in.	Bottom	0	in.	Left	36	in.

Note: Please refer to the tech guide for listed maximum static pressures

6.5 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 180 MBH Input Aluminized Steel, Two Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Reciprocating Compressor
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- 1.5 HP Standard Static Belt Drive Blower
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 20"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Through-the-Curb and Through-the-Base Utility Connections
- Single Point Power Connection
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.
- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017**

Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **2** Tag #: **6.5 Ton Horizontal**

System: **ZJ078N18P4B1AAA1A1 (2)**

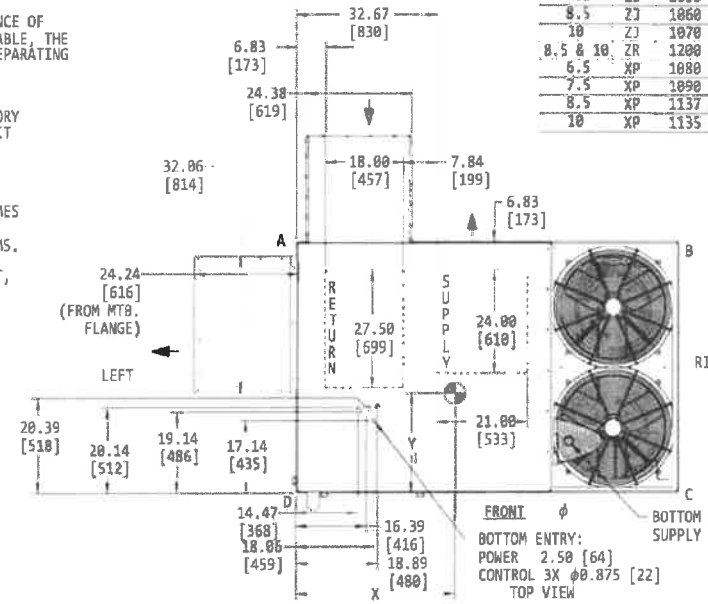
Consolidated Drawing

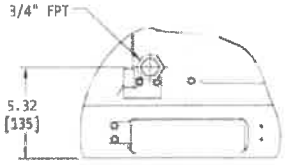
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   - RIGHT SIDE: 12 [305]
   - LEFT SIDE: 36 [915]
   - FRONT: 36 [915]
   - REAR: 36 [915]
   - TOP: 72 [1830]
   - BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF AND FRESH AIR HOODS SHOWN.
11. EXCEPT XP (HEAT PUMP) UNITS.

DIRECTION OF AIRFLOW

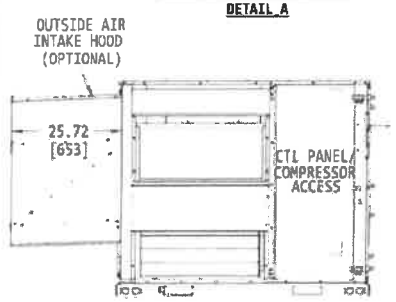
CENTER OF GRAVITY

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)		CENTER OF GRAVITY LOCATION (BASE UNIT) X		Y		4 POINT CORNER LOADS (LBS) (BASE UNIT) A		B		C		D	
6.5	ZF	1007	458	38	965	24	610	235	107	175	79	255	116	342	155
10	ZF	1103	501	38	965	24	610	257	117	192	87	279	127	375	170
8.5	ZH	1030	467	38	965	24	610	240	109	179	81	261	118	350	159
10	ZH	1090	494	38	965	24	610	254	115	189	86	276	125	371	168
6.5	ZJ	1030	467	39	991	25	635	245	111	191	87	260	118	333	151
7.5	ZJ	1050	476	39	991	25	635	250	113	195	89	265	120	340	154
8.5	ZJ	1060	481	38	965	24	610	247	112	184	84	268	122	360	163
10	ZJ	1070	485	39	991	24	610	245	111	191	87	278	126	357	162
8.5 & 10	ZR	1200	544	38	965	25.5	[648]	297	135	221	[100]	291	132	390	177
6.5	XP	1080	490	38	965	25	[635]	262	119	195	[89]	266	121	357	162
7.5	XP	1090	494	38	965	23	584	243	110	181	82	284	129	381	173
8.5	XP	1137	516	38	965	25.5	[648]	282	128	210	95	276	125	370	168
10	XP	1135	515	38	965	25.5	[648]	281	127	209	95	275	125	369	167

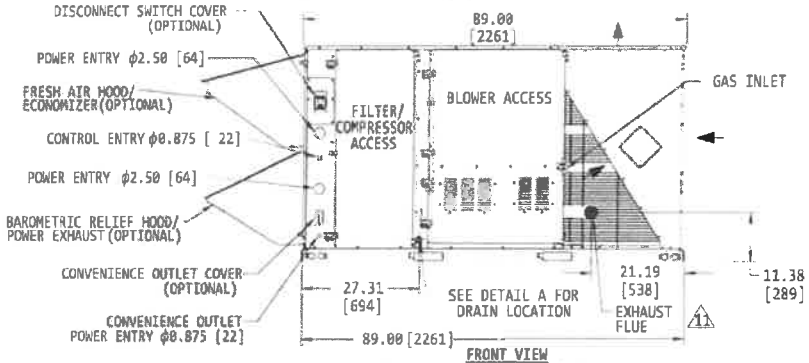




DETAIL A

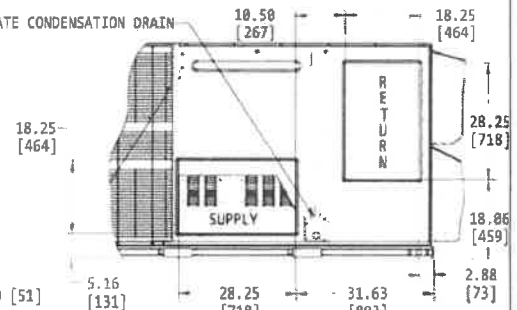


LEFT VIEW



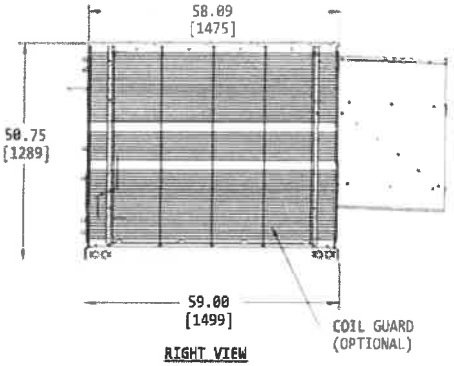
FRONT VIEW

(OPTIONAL FRONT COIL GUARD NOT SHOWN IN THIS VIEW)



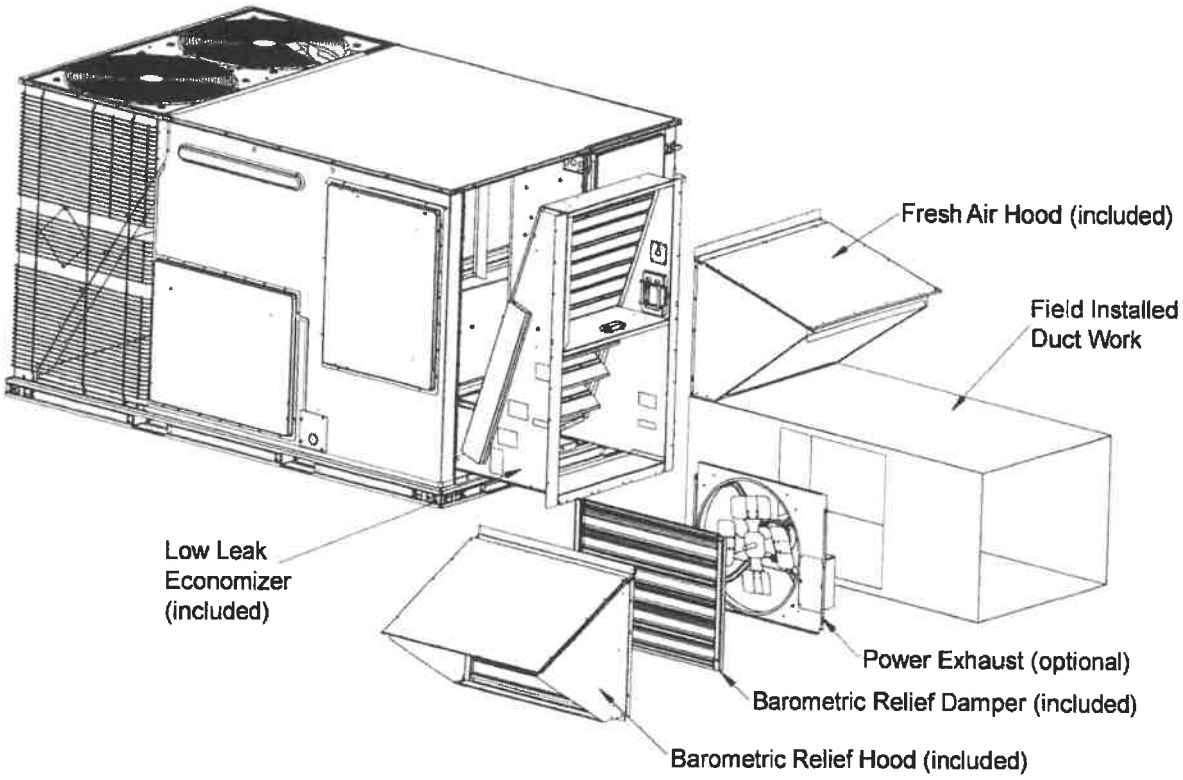
REAR (PARTIAL VIEW)

(INTAKE HOOD NOT SHOWN IN THIS VIEW)



RIGHT VIEW

Low Leak Economizer End Return (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

ASHRAE 90.1-2010
ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
International Energy Conservation Code (IECC)
California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

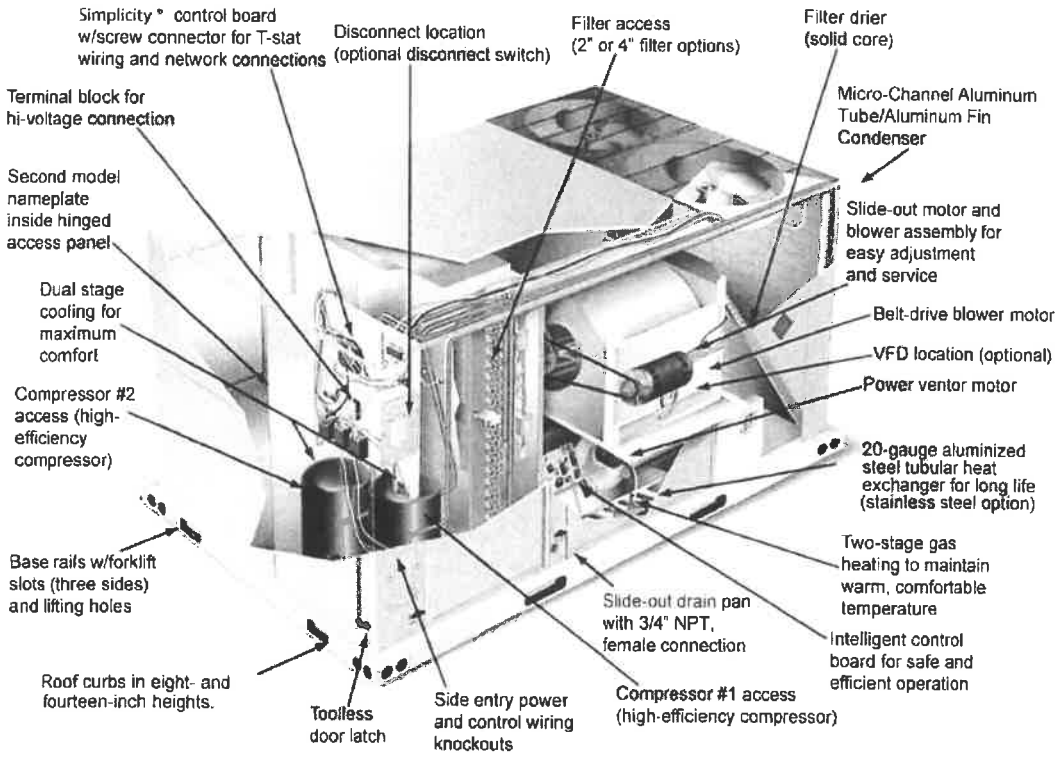
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Dave Nowak RTU Quote 08222017** Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **2** Tag #: **6.5 Ton Horizontal** System: **ZJ078N18P4B1AAA1A1 (2)**

Component Location

6 1/2 Through 10 Tons



YORK® Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017** | Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **1** Tag #: **6.5 Ton Down Flow** | System: **ZJ078N18P4B1AAA1A1**

Cooling Performance		
Total gross capacity	86.1	MBH
Sensible gross capacity	61.4	MBH
Total net capacity	82.0	MBH
Sensible net capacity	57.3	MBH
Efficiency (at ARI)	11.80	EER
Integrated eff. (at ARI)	14.60	IEER
Ambient DB temp.	86.5	°F
Entering DB temp.	80.0	°F
Entering WB temp.	67.0	°F
Leaving DB temp.	58.1	°F
Leaving WB temp.	56.4	°F
Power input (w/o blower)	5.18	kW
Sound power	85	dB(A)

Refrigerant		
Refrigerant type	R-410A	
Sys1	5 lbs 10 oz	
Sys2	5 lbs 12 oz	

Gas Heating Performance		
Entering DB temp.	60	°F
Heating output capacity (Max)	144	MBH
Supply air	2600	CFM
Heating input capacity (Max)	180	MBH
Leaving DB temp.	111.3	°F
Air temp. rise	51.3	°F
SSE	80.0	%
Stages	2	

Supply Air Blower Performance		
Supply air	2600	CFM
Ext. static pressure	0.6	IWG
Addl. Unit Losses (Options/Accessories)	0.14	IWG
Blower speed	857	RPM
Max BHP of Motor (including service factor)	1.73	HP
Duct location	Bottom	
Motor rating	1.50	HP
Actual required BHP	1.31	HP
Power input	1.21	kW
Elevation	705	ft.
Drive type	BELT	

Electrical Data		
Power supply	460-3-60	
Unit min circuit ampacity	16.1	Amps
Unit max over-current protection	20	Amps

Dimensions & Weight						
Hgt	51 in.	Len	89 in.	Wth	59	in.
Weight with factory installed options					1225	lbs.

Clearances					
Right	12 in.	Front	36 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.

Note: Please refer to the tech guide for listed maximum static pressures

6.5 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 180 MBH Input Aluminized Steel, Two Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Reciprocating Compressor
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- 1.5 HP Standard Static Belt Drive Blower
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 20"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Through-the-Curb and Through-the-Base Utility Connections
- Single Point Power Connection
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

BAS Controller

- IntelliSpeed control of the VFD based on stages of cooling. Provides Single Zone VAV Fan Operation as defined by ASHRAE 90.1 section 6.4.3.10.
- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger

Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: **Dave Nowak RTU Quote 08222017**

Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **1** Tag #: **6.5 Ton Down Flow**

System: **ZJ078N18P4B1AAA1A1**

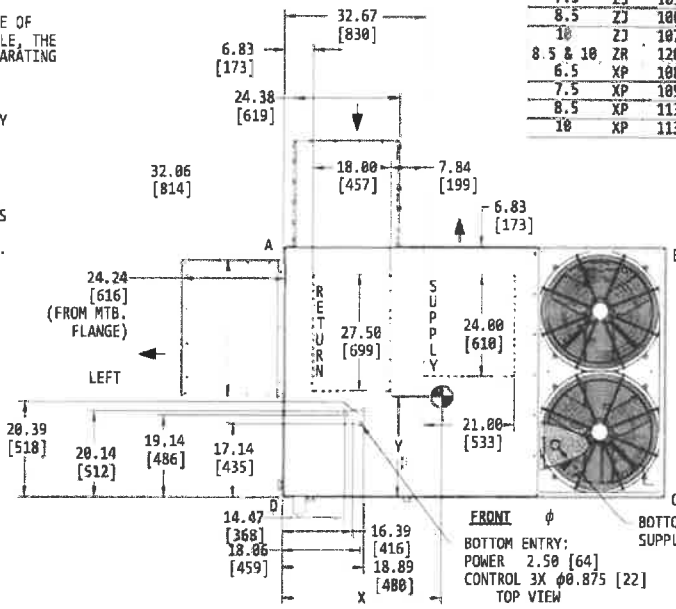
Consolidated Drawing

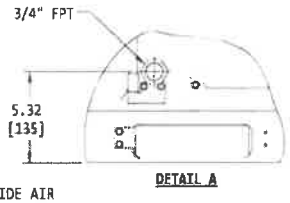
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   - RIGHT SIDE: 12 [305]
   - LEFT SIDE: 36 [915]
   - FRONT: 36 [915]
   - REAR: 36 [915]
   - TOP: 72 [1830]
   - BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF AND FRESH AIR HOODS SHOWN.
11. EXCEPT XP (HEAT PUMP) UNITS.

→ DIRECTION OF AIRFLOW

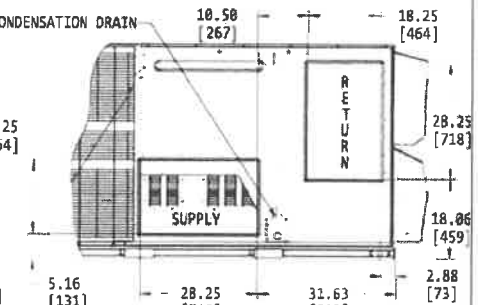
⊕ CENTER OF GRAVITY

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT) X		Y		4 POINT CORNER LOADS (LBS) (BASE UNIT) A		B		C		D	
8.5	ZF	1007	458	38	965	24	610	235	107	175	79	255	116	342	155
10	ZF	1103	501	38	965	24	610	257	117	192	87	279	127	375	170
8.5	ZH	1030	467	38	965	24	610	240	109	179	81	261	118	350	159
10	ZH	1090	494	38	965	24	610	254	115	189	86	276	125	371	168
6.5	ZJ	1030	467	39	991	25	635	245	111	191	87	260	118	333	151
7.5	ZJ	1050	476	39	991	25	635	250	113	195	89	265	120	340	154
8.5	ZJ	1060	481	38	965	24	610	247	112	184	84	268	122	360	163
10	ZJ	1070	485	39	991	24	610	245	111	191	87	278	126	357	162
8.5 & 10	ZR	1200	544	38	965	25.5	[648]	297	135	221	[100]	291	132	398	177
6.5	XP	1080	490	38	965	25	635	262	119	195	89	266	121	357	162
7.5	XP	1090	494	38	965	23	584	243	110	181	82	284	129	381	173
8.5	XP	1137	516	38	965	25.5	[648]	282	128	210	95	276	125	370	168
10	XP	1135	515	38	965	25.5	648	281	127	289	95	275	125	369	167

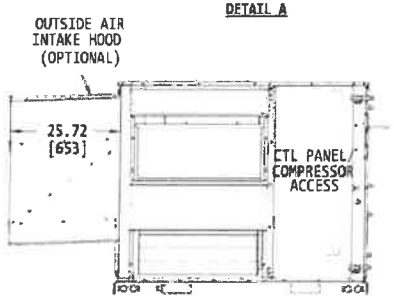




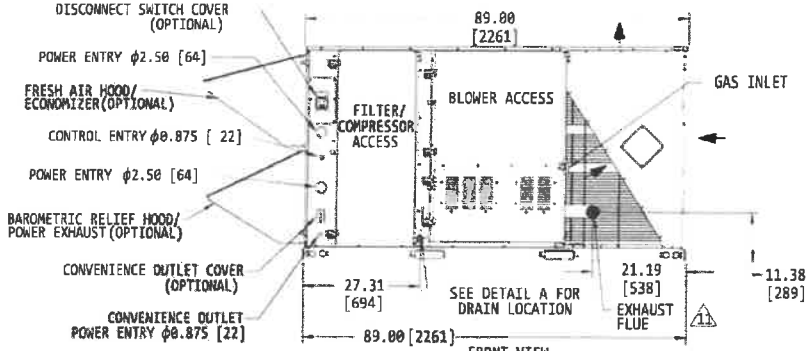
DETAIL A



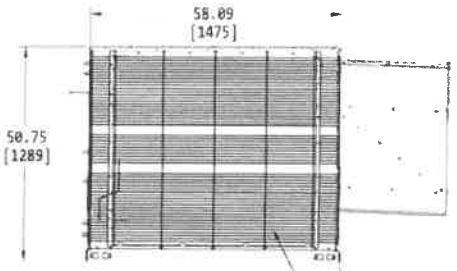
REAR (PARTIAL VIEW)
(INTAKE HOOD NOT SHOWN IN THIS VIEW)



LEFT VIEW

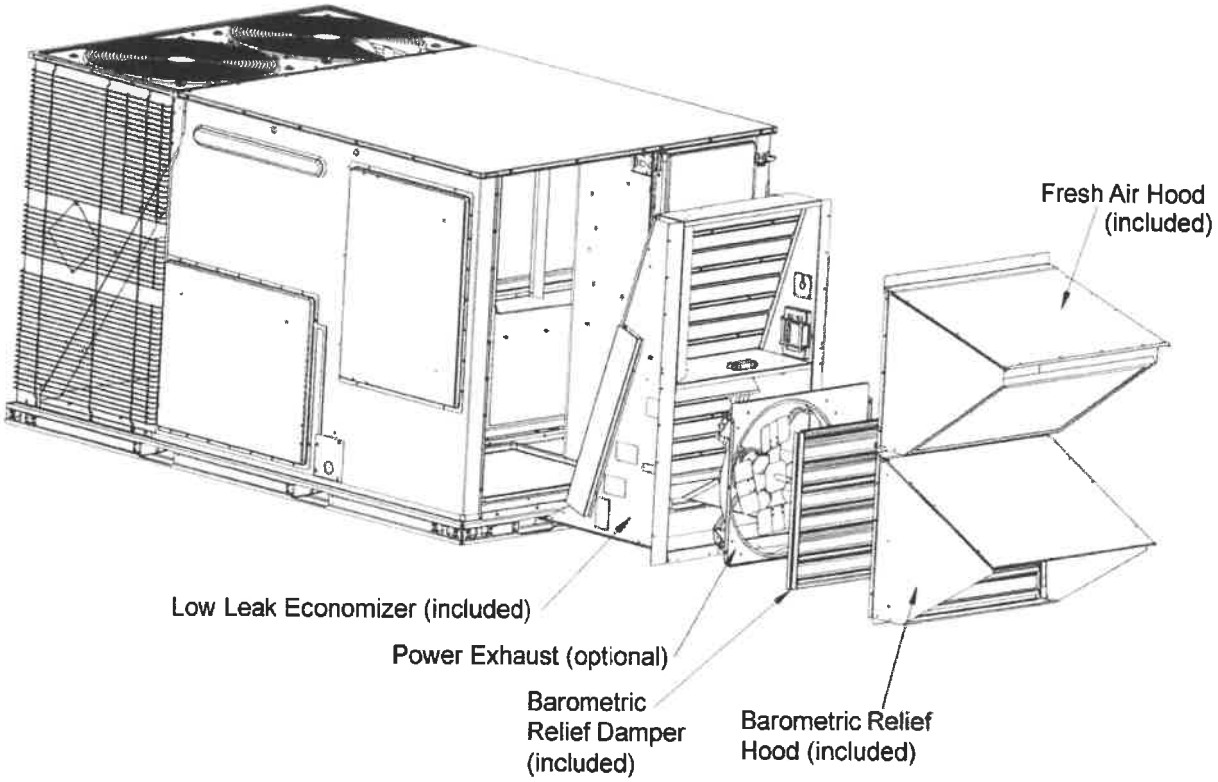


FRONT VIEW
(OPTIONAL FRONT COIL GUARD NOT SHOWN IN THIS VIEW)



RIGHT VIEW

Low Leak Downflow Economizer (shown with optional Power Exhaust)



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ASHRAE 62
AMCA 511 (licensed as Class 1A damper)
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California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

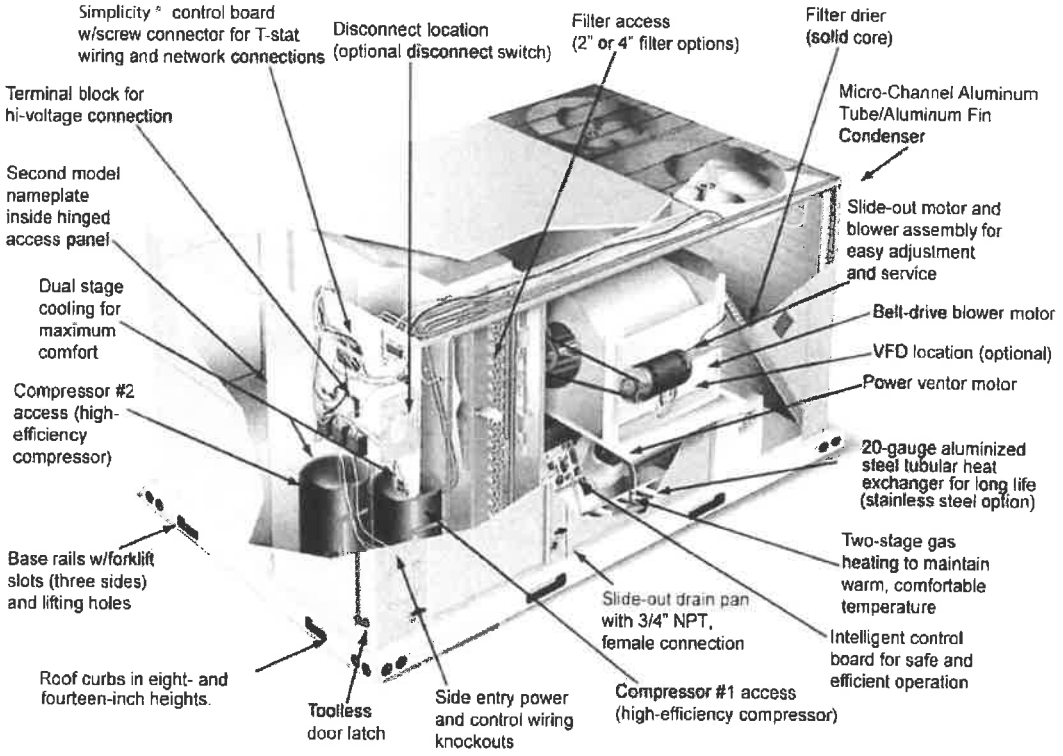
Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

Project Name: **Dave Nowak RTU Quote 08222017** Unit Model #: **ZJ078N18P4B1AAA1A1**

Quantity: **1** Tag #: **6.5 Ton Down Flow** System: **ZJ078N18P4B1AAA1A1**

Component Location

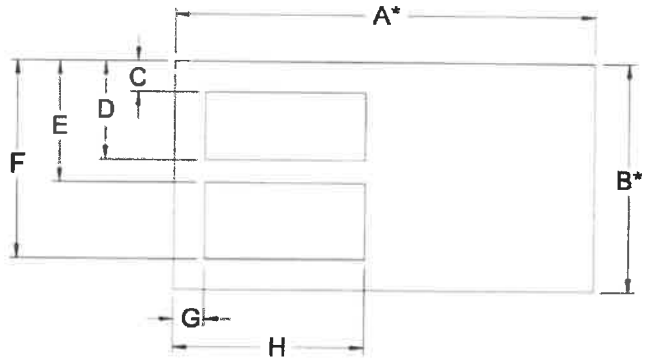
6 1/2 Through 10 Tons



CDI EXISTING CURB VERIFICATION

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
01	INITIAL DRAWING	11/18/2004	TC
02	JPDATED ADDRESS	6/18/2007	TC
03	ADDED OVERSIZE NOTE	6/5/12	MWG
04	ADD BRAND AND MODEL NOTE	4/21/2014	HMH

PLEASE DO NOT USE RTU DIMENSIONS



***CDI WILL BE ADDING 1-1/2" (1.5") OVERSIZE TO THE CURB OD'S (A & B). PLEASE PROVIDE ONLY ACTUAL CURB DIMENSIONS (DO NOT ADD OVERSIZE)**

EXISTING UNIT BRAND_____

MODEL_____

A*	B*	C	D
E	**F**	**G**	**H**

PLEASE FILL IN CURB DIMENSIONS "A" THROUGH "H" AND NOTE RETURN AND SUPPLY, FEEL FREE TO CALL(1-888-234-7001) WITH ANY QUESTIONS

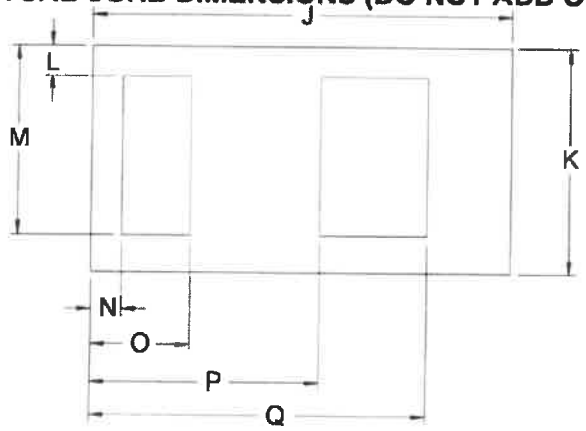
Please also note the following information
- **Note any obstructions near the existing curb (EX. Wall, Other units, Hoods, etc)**
- **Note any height restrictions.**
- **Note existing curb height.**

J*	K*	L	M
N	**O**	**P**	**Q**

EXISTING UNIT BRAND_____

MODEL_____

***CDI WILL BE ADDING 1-1/2" (1.5") OVERSIZE TO THE CURB OD'S (J & K). PLEASE PROVIDE ONLY ACTUAL CURB DIMENSIONS (DO NOT ADD OVERSIZE)**



APPROVALS	DATE
hhorn	4/21/2014

TITLE: CDI EXISTING CURB VERIFICATION

CDI
17860 TYLER ST NW
ELK RIVER, MN 55330
(763)391-7790
(763)391-7851

FILE NAME: 9999 REV4

DRAWING NO: 9999 REV4

REV: 04

SCALE: 1:15 SHEET 1 OF 1