



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

May 2018

Log No. 19-WSEC-R28

Code being amended: Commercial Provisions Residential Provisions

Code Section # 403.1.3, 403.10.1

Brief Description:

This proposal seeks to prohibit the use of standing (or continuous) pilot lights on select gas-fired appliances. Non-continuous ignition types have long existed in the market to replace antiquated standing pilot lights for many household appliances and space heating systems.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

R403.1.3 Continuously Burning Pilot Lights. The natural gas systems and equipment listed below are not permitted to be equipped with continuously burning pilot lights:

- a. Fan-type central furnaces.
- b. Household cooking appliances.
EXCEPTION: Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.
- c. Pool heaters.
- d. Spa heaters.
- e. Fireplaces.

R403.10.1 Heaters. The electric power to heaters shall be controlled by a readily accessible on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. ~~Gas-fired heaters shall not be equipped with continuously burning ignition pilots.~~

Purpose of code change:

Standing pilot lights are no longer necessary with many gas-fired appliances and space heating systems offering market accepted alternative methods. Some models allow standing pilots to operate for a few hours after shutdown and then use electronic ignition to re-start, allowing a variety of models to exist in the market that save energy over continuously burning pilot lights.

A new section is proposed in the WSEC that lists the gas-fired appliances that are prohibited from using standing pilot lights. Code already prohibits standing pilot lights on pool and spa heaters and therefore the existing reference in section R403.10.1 is removed and pool and spa heaters are listed in the newly created section R403.1.3 to maintain clarity and concise placement throughout the code.

Your amendment must meet one of the following criteria. Select at least one:

- | | |
|--|---|
| <input type="checkbox"/> Addresses a critical life/safety need. | <input type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code. | <input type="checkbox"/> Addresses a unique character of the state. |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.
(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions. |

Check the building types that would be impacted by your code change:

- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Single family/duplex/townhome | <input type="checkbox"/> Multi-family 4 + stories | <input type="checkbox"/> Institutional |
| <input checked="" type="checkbox"/> Multi-family 1 – 3 stories | <input type="checkbox"/> Commercial / Retail | <input type="checkbox"/> Industrial |

Your name	Nicholas O'Neil	Email address	noneil@energy350.com
Your organization	Energy 350	Phone number	503-333-8161
Other contact name	Louis Starr		

Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

Since gas heating appliances with standing pilot lights consume gas even during non-heating months of the year, using one that has intermittent ignition saves gas for a significant number of hours per year. The primary economic benefit to the homeowner is lower gas bills over the course of the year by using appliances that consumes gas in a more efficient manner compared to those that utilize continuously burning pilot lights.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). [Webinars on the tool can be found Here and Here](#))

\$0.047/square foot (For residential projects, also provide \$105/ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

This prohibition is not expected to add significant cost to any gas-fired appliance or heating system. Past studies have shown between \$80 and \$105 increase in price to move from a standard continuously lit pilot light to an intermittent ignition system on fireplaces. Costs are based on recently conducted market studies from the Energy Trust of Oregon and support data from DOE on costs for intermittent ignition systems.

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

-0.015 KWH/ square foot (or) 1.27 KBTU/ square foot (based on a 2,200 sqft home)

(For residential projects, also provide -0.012 KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

To calculate energy savings we relied on work done by the Energy Trust of Oregon on fireplace operating hours as well as DOE during its rulemaking process in 2013 under the *Energy Conservation Program for Consumer Products: Proposed Determination of Hearth Products as a Covered Consumer Product*.

Determining the annual energy consumption of each hearth product ignition system was done by multiplying the heat input of natural gas by the number of hours the pilot ignition system would otherwise be on when the appliance was not in use. The following equation was used to determine the energy use for each ignition system:

$$EnergyUse_{Total} = Q_p \times OH_p + Secondary\ Effects$$

Where:

- **Ignition system power (QP):** Standing pilot (SP) or intermittent pilot (IPI) ignition system power
 - **SP:** Fuel input consumed by the standing pilot, Btu/hr.
 - **IPI:** Electrical power consumed by the intermittent pilot ignition system, W.
- **Ignition System Operating Hours (OHP):** On-time of the SP or IPI ignition system.
 - **SP:** Determined using field studies and Energy Trust of Oregon survey and metering data.
 - **IPI:** Determined based on hearth product main burner operation.
- **Impact on Space Heating or Cooling Energy Use (Secondary Effects):** Impact of ignition operation on household space conditioning system energy use.
 - **Heating Season:** SP heat is counted as beneficial heat and reduces furnace operating hours.
 - **Non-Heating Season:** SP heat is counted as an additional cooling load and increases air-conditioning operating hours.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

The market share and weight of different ignition types was used in the analysis and is shown in the table below.

Hearth Product Group	Estimated Market Share (%)			Shipments
	Match Lit	Standing Pilot	Electronic Ignition	Representative Shipment Volume
Vented Fireplace, Insert, Stove	5	40	55	10,000
Unvented Fireplace, Insert, Stove	0	88	12	2,000
Vented Gas Log Sets	50	44	6	2,000
Unvented Gas Log Sets	0	94	6	5,000
Outdoor	50	26	24	3,000

The ignition system representative power is shown in the table below based on manufacturer data. Using shipment and market share information above combined with the ignition system energy consumption, a weighted average pilot light btu/h and IPI Wattage was determined and shown in the table below.

Hearth Product Type	Standing Pilot (Btu/h)	Intermittent Pilot Ignition (W)	Main Burner (Btu/h)
Vented Fireplace, Insert, Stove	1,000	50	35,000
Unvented Fireplace, Insert, Stove	1,200	50	30,000
Vented Gas Log Sets	700	50	35,000
Unvented Gas Log Sets	800	50	25,000
Outdoor*	1,000	50	50,000
Average	951	50	
Average (excluding Outdoor)	946	50	

** Though outdoor fireplaces are shown in the table for consistency with the DOE determination, they are excluded from the proposal analysis related to indoor gas appliances.*

The weighted average heat input of the pilot light is therefore 946 Btu/h and the IPI is 50 W.

To determine the hours of use the standing pilot ignition was on during a year, the DOE technical support document relied on RECS surveys and CANMET surveys and the distribution of operating hours based on the mode and reporting of how many users leave their pilot light on all year. Results from the studies indicated that 40% of users left the ignition for the whole year, 20% turn it off daily, and the remaining 40% had many users turning the SP off at the end of the heating season. From this data the average operating hours for SP fireplaces was found to be 3,708 hours/year.

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To determine IPI operating hours several assumptions were made based on the DOE test procedure for vented home heating equipment.

Assumptions:

- *Average Main Burner cycle time = 20 minutes*
- *Main Burner Cycles per hour = 3*
- *IPI Operation per Cycle = 30 seconds*

Using these assumptions the resulting average IPI operating hours was found to be 3.9 hours/year

To determine secondary effects, the following equation was used along with the stated assumptions.

$$(Secondary\ Effects)_s = \frac{E_{USE_pilot} * \eta_p}{\eta_s}$$

Where:

- *s (index)= season (heating or cooling season)*
- *Q_p = power consumption of the pilot*
- *OH_{p,s} = pilot operating hours in that season*
- *E_{USE,pilot} = energy consumed by the pilot*
- *η_p = fraction of useful heat from the pilot*
 - *Distribution based on field study*
 - *Assumed half for decorative units*
 - *Assumed double for unvented units*
- *η_s = efficiency of the main heating or cooling appliance*

Combining the values found above into the primary Energy use equation for each type yields the following results.

Summary of Standing Pilot Results

Hearth Product Type	Total Fuel Use* (MMBtu/yr)
Vented Fireplace, Insert, Stove	3.99
Unvented Fireplace, Insert, Stove	3.52
Vented Gas Log Sets	3.13
Unvented Gas Log Sets	2.29
Outdoor	3.91
All SP Hearth Products	3.58
All SP Hearth Products (Excluding Outdoor)	3.40

* No electricity used by SP

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Summary of IPI Results

Hearth Product Type	Electricity Use** (kWh/yr)	Space Heating Fuel Impact† (MMBtu/yr)	Space Heating Electricity Impact† (kWh/yr)	Space Cooling Electricity Impact† (kWh/yr)
Vented Fireplace, Insert, Stove	0.19	0.50	25.2	-12.8
Unvented Fireplace, Insert, Stove	0.18	1.30	155	-49.5
Vented Gas Log Sets	0.30	0.29	15.5	-7.0
Unvented Gas Log Sets	0.22	0.92	102	-49.5
Outdoor	0.18	0.00	0.00	0.0
All IPI Hearth Products***	0.20	0.58	45.5	-21.1
All IPI Hearth Products (excluding Outdoor)***	0.21	0.67	58.05	25.71

** No fuel use by IPI.

*** Total impact of IPI calculated using the market-share-weighted average of each product type.

†Reflects impacts of lack of standing pilot heat

The final analysis indicates that IPI consumption over SP consumption (excluding outdoor units) results in a total of **28 therms/yr of gas savings with an increased electricity consumption of 33 kWh/yr**. Details of the LCC analysis can be found in the associated LCC calculator.

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

No significant enforcement is expected by the plans examiner or inspector. Standing pilot lights can be visually seen and noted if present, and plans examiners can check model numbers for furnaces and cooking appliances prior to installation to ensure the model selected has a non-continuous ignition type. Section 110.5 of the 2016 Title 24 in California prohibits pilot lights for natural gas furnaces, cooking equipment, and pool and spa heaters so precedent exists already at the state code level.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Office of Financial Management
 Olympia, Washington - Version: 2018-Residential
 Life Cycle Cost Analysis Tool
Executive Report

Project Information	
Project:	
Address:	
Company:	Energy 350
Contact:	Nicholas O'Neil
Contact Phone:	503-333-8161
Contact Email:	noneil@energy350.com

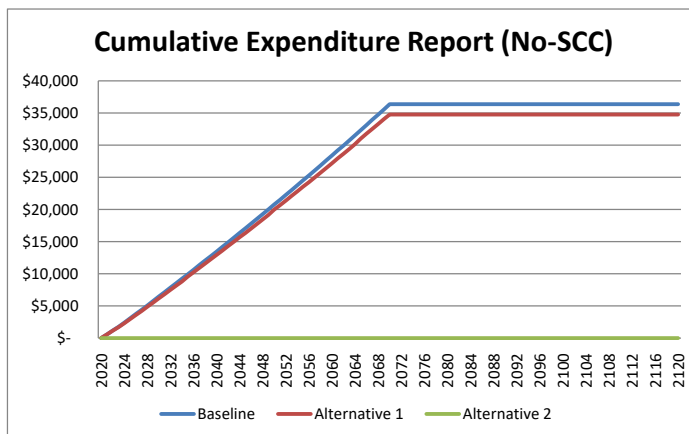
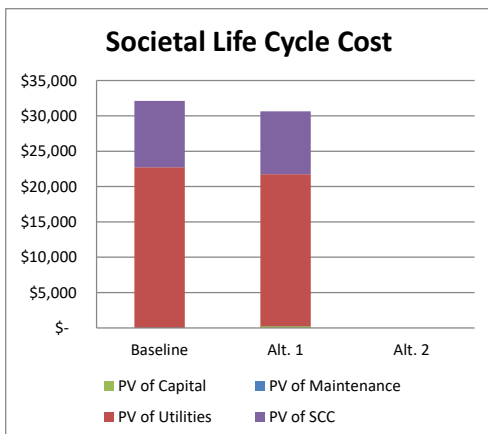
Key Analysis Variables		Building Characteristics	
Study Period (years)	50	Gross (Sq.Ft)	2,200
Nominal Discount Rate	5.00%	Useable (Sq.Ft)	2,200
Maintenance Escalation	1.00%	Space Efficiency	100.0%
Zero Year (Current Year)	2020	Project Phase	0
Construction Years	0	Building Type	0

Life Cycle Cost Analysis		BEST	
Alternative	Baseline	Alt. 1	Alt. 2
Energy Use Intensity (kBtu/sq.ft)	25.3	24.0	
1st Construction Costs	\$ -	\$ 105	\$ -
PV of Capital Costs	\$ -	\$ 259	\$ -
PV of Maintenance Costs	\$ -	\$ -	\$ -
PV of Utility Costs	\$ 22,723	\$ 21,488	\$ -
Total Life Cycle Cost (LCC)	\$ 22,723	\$ 21,747	\$ -
Net Present Savings (NPS)	N/A	\$ 976	\$ -

Societal LCC takes into consideration the social cost of carbon dioxide emissions caused by operational energy consumption

(GHG) Social Life Cycle Cost		BEST	
GHG Impact from Utility Consumption	Baseline	Alt. 1	Alt. 2
Tons of CO2e over Study Period	148	140	-
% CO2e Reduction vs. Baseline	N/A	5%	106%
Present Social Cost of Carbon (SCC)	\$ 9,398	\$ 8,895	\$ -
Total LCC with SCC	\$ 32,121	\$ 30,642	\$ -
NPS with SCC	N/A	\$ 1,479	\$ -

Warning: OFM Assigned Variables Not Used



Baseline Short Description
Alternative 1 Short Description
Alternative 2 Short Description

Cumulative Expenditure Summary				Annual Expenditure Summary		
Year	Baseline	Alt. 1	Alt. 2	Baseline	Alt. 1	Alt. 2
2020	\$ -	\$ 21	\$ -	\$ -	\$ 21	\$ -
2021	\$ 592	\$ 586	\$ -	\$ 592	\$ 565	\$ -
2022	\$ 1,178	\$ 1,146	\$ -	\$ 586	\$ 559	\$ -
2023	\$ 1,765	\$ 1,705	\$ -	\$ 586	\$ 559	\$ -
2024	\$ 2,403	\$ 2,313	\$ -	\$ 639	\$ 609	\$ -
2025	\$ 3,071	\$ 2,950	\$ -	\$ 668	\$ 636	\$ -
2026	\$ 3,738	\$ 3,585	\$ -	\$ 668	\$ 636	\$ -
2027	\$ 4,411	\$ 4,227	\$ -	\$ 673	\$ 641	\$ -
2028	\$ 5,085	\$ 4,868	\$ -	\$ 673	\$ 641	\$ -
2029	\$ 5,770	\$ 5,519	\$ -	\$ 685	\$ 652	\$ -
2030	\$ 6,460	\$ 6,177	\$ -	\$ 691	\$ 657	\$ -
2031	\$ 7,151	\$ 6,834	\$ -	\$ 691	\$ 657	\$ -
2032	\$ 7,842	\$ 7,491	\$ -	\$ 691	\$ 657	\$ -
2033	\$ 8,533	\$ 8,148	\$ -	\$ 691	\$ 657	\$ -
2034	\$ 9,229	\$ 8,810	\$ -	\$ 697	\$ 662	\$ -
2035	\$ 9,926	\$ 9,577	\$ -	\$ 697	\$ 767	\$ -
2036	\$ 10,628	\$ 10,244	\$ -	\$ 702	\$ 667	\$ -
2037	\$ 11,330	\$ 10,912	\$ -	\$ 702	\$ 667	\$ -
2038	\$ 12,039	\$ 11,584	\$ -	\$ 708	\$ 673	\$ -
2039	\$ 12,747	\$ 12,257	\$ -	\$ 708	\$ 673	\$ -
2040	\$ 13,461	\$ 12,935	\$ -	\$ 714	\$ 678	\$ -
2041	\$ 14,175	\$ 13,613	\$ -	\$ 714	\$ 678	\$ -
2042	\$ 14,894	\$ 14,296	\$ -	\$ 720	\$ 683	\$ -
2043	\$ 15,614	\$ 14,980	\$ -	\$ 720	\$ 683	\$ -
2044	\$ 16,340	\$ 15,668	\$ -	\$ 726	\$ 689	\$ -
2045	\$ 17,065	\$ 16,357	\$ -	\$ 726	\$ 689	\$ -
2046	\$ 17,797	\$ 17,051	\$ -	\$ 731	\$ 694	\$ -
2047	\$ 18,534	\$ 17,750	\$ -	\$ 737	\$ 699	\$ -
2048	\$ 19,271	\$ 18,450	\$ -	\$ 737	\$ 699	\$ -
2049	\$ 20,012	\$ 19,152	\$ -	\$ 741	\$ 703	\$ -
2050	\$ 20,756	\$ 19,963	\$ -	\$ 744	\$ 811	\$ -
2051	\$ 21,504	\$ 20,670	\$ -	\$ 748	\$ 707	\$ -
2052	\$ 22,255	\$ 21,380	\$ -	\$ 751	\$ 710	\$ -
2053	\$ 23,009	\$ 22,094	\$ -	\$ 755	\$ 714	\$ -
2054	\$ 23,767	\$ 22,811	\$ -	\$ 758	\$ 717	\$ -
2055	\$ 24,529	\$ 23,531	\$ -	\$ 762	\$ 720	\$ -
2056	\$ 25,294	\$ 24,254	\$ -	\$ 765	\$ 723	\$ -
2057	\$ 26,062	\$ 24,981	\$ -	\$ 769	\$ 727	\$ -
2058	\$ 26,834	\$ 25,711	\$ -	\$ 772	\$ 730	\$ -
2059	\$ 27,610	\$ 26,445	\$ -	\$ 775	\$ 733	\$ -
2060	\$ 28,389	\$ 27,181	\$ -	\$ 779	\$ 737	\$ -
2061	\$ 29,171	\$ 27,921	\$ -	\$ 782	\$ 740	\$ -
2062	\$ 29,957	\$ 28,665	\$ -	\$ 786	\$ 743	\$ -
2063	\$ 30,747	\$ 29,411	\$ -	\$ 789	\$ 747	\$ -
2064	\$ 31,540	\$ 30,161	\$ -	\$ 793	\$ 750	\$ -
2065	\$ 32,336	\$ 31,019	\$ -	\$ 796	\$ 858	\$ -
2066	\$ 33,136	\$ 31,775	\$ -	\$ 800	\$ 756	\$ -
2067	\$ 33,939	\$ 32,535	\$ -	\$ 803	\$ 760	\$ -
2068	\$ 34,746	\$ 33,298	\$ -	\$ 807	\$ 763	\$ -
2069	\$ 35,556	\$ 34,065	\$ -	\$ 810	\$ 766	\$ -
2070	\$ 36,370	\$ 34,764	\$ -	\$ 814	\$ 700	\$ -
2071	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2072	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2073	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2074	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2075	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2076	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2077	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2078	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2079	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2080	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2081	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2082	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2083	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2084	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2085	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2086	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2087	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -

Cumulative Expenditure Summary				Annual Expenditure Summary		
Year	Baseline	Alt. 1	Alt. 2	Baseline	Alt. 1	Alt. 2
2088	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2089	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2090	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2091	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2092	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2093	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2094	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2095	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2096	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2097	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2098	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2099	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2100	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2101	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2102	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2103	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2104	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2105	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2106	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2107	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2108	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2109	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2110	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2111	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2112	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2113	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2114	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2115	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2116	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2117	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2118	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2119	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -
2120	\$ 36,370	\$ 34,764	\$ -	\$ -	\$ -	\$ -