# Electric Hybrid Boiler Systems



# PATTERSON-KELLEY HISTORY



A company heirloom autographed by Thomas A. Edison in 1901

Founded in 1880 as Benjamin F. Kelley & Company, Patterson-Kelley has evolved over the years, continually adapting and changing to lead the marketplace.

In fact, the company's very first product, feed water heaters, introduced pioneering technology with "U" tube bundles.

Following the death of its founder, the Kelley Company merged in 1917 with his son-in-law's organization, Frank L. Patterson & Company.

After World War II the business focus shifted from storage water heaters to more complicated, customerengineered heat exchangers and other commercial and industrial products.

With over 125 years of experience and an innovative R&D pipeline, P-K is highly regarded for bringing valueadded solutions to the marketplace.



# PATTERSON-KELLEY HISTORY





Company Confidential | Copyright © 2020 Patterson-Kelley, LLC

# PATTERSON-KELLEY HISTORY





# **P-K BOILER PORTFOLIO**



Condensing Boilers Efficiencies> 86%

> MACH® SONIC® STORM® SOLIS®



Non-Condensing Boilers Efficiencies</= 86%

MFD® Thermific VELOX®



# P-K WATER HEATER PORTFOLIO







**Gas-Fired Direct** 

**Gas-Fired Indirect** 

Indirect

# ELECTRIC HYBRID/DUAL FUEL BOILER SYSTEMS



- Commercial boiler installations featuring both high efficiency condensing boilers and/or standard efficiency non-condensing boilers with an electrified appliance counterpart.
- □ The electric heat pump(s) take the lead position and are given priority operation throughout the majority of the heating season.
  - The electric heat pumps are fully utilized when the system supply temperature is below 130°F.
- □ The boiler(s) take the lag position and are primarily reserved for the coldest days of the heating season.
  - The non-condensing boiler(s) are fully utilized when the system supply temperature is above 130°F.

# HYBRID BOILER SYSTEM OBJECTIVES



- Reduce the equipment cost by balancing the load between heat pump technology and boilers.
- Normalize the equipment costs pay a slight premium for heat pump capabilities but avoid overpaying.
  - ✓ Heat Pumps: Approximately \$60 \$100+ per MBTUH
  - Boilers: Approximately \$13- \$33 per MBTUH
- Leverage the overall system modulation/turndown to eliminate short-cycling of the boiler equipment.
- □ Establish an extended Outdoor Air Reset curve to promote the use of the high efficiency equipment.
- **Provide suitable equipment redundancy.**



Avg																					
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Avg	1																%	%	%	
63       62       64       336       23       45       46       40       45       102       23       11       522       5.22       2.78         61       60       62       308       20       45       45       48       40       59       40       10       1       4.80       10.02       5.66         59       58       60       200       17       39       33       142       36       16       3       1       1.312       1.314       8.33         57       56       58       273       4       4       29       71       36       22       21       32       45       8       1       4.26       17.40       11.314       8.33         53       52       54       26       35       38       11       1       32       64       27       3       362       30.93       19.44         49       48       50       238       1       7       18       62       22       8       53       39       16       35.4       42.20       27.78         47       46       42       27       2       30       55       22 <td>  T</td> <td>BIN</td> <td>to</td> <td>Range</td> <td>TOT</td> <td>J</td> <td>F</td> <td>M</td> <td>А</td> <td>M</td> <td>J</td> <td>J</td> <td>А</td> <td>S</td> <td>0</td> <td>N</td> <td>D</td> <td>TOT</td> <td>CUM</td> <td>LOAD</td> <td></td>	T	BIN	to	Range	TOT	J	F	M	А	M	J	J	А	S	0	N	D	TOT	CUM	LOAD	
61       60       62       308       200       45       45       48       40       59       40       10       1       4.80       10.02       5.56         57       56       58       60       200       17       39       33       13       42       36       16       3       1       3.12       13.14       8.33         57       56       58       261       54       266       351       8       4       6       38       68       32       10       17       46       89       31       2       5.47       22.87       13.89       56       551       50       52       22.22       3       16       52       33       42       47       1       4.44       27.32       16.67         51       50       52       22       30       55       22       52       2       8       53       39       16       3.54       42.02       27.78         43       42       44       267       4       6       20       52       24       15       52       15       52.81       14       46.68       30.05         43       42       44	63	62		64	335				23	45	46	40	45	102	23	11		5.22	5.22	2.78	
59       58       60       200       17       39       33       13       42       36       16       3       1       3.12       13.14       8.33         57       56       58       273       4       4       29       71       36       22       12       12       14       6       3       1       3.12       13.14       8.33         53       52       54       266       5       3       28       46       42       16       6       2       38       51       47       1       4.44       27.32       16.67         51       50       52       232       2       3       16       35       38       11       1       32       64       47       11       3.71       3.462       30.33       19.44         49       48       502       238       1       7       18       50       52       22       8       51       21       4.02       38.67       25.00         45       44       46       227       2       30       55       22       4       40       41       28       36.13       33.33       33       33.33	61	60		62	308				20	45	45	48	40	59	40	10	1	4.80	10.02	5.56	
57       56       58       273       4       4       29       71       36       22       21       32       45       8       1       4.26       17.40       11.11         55       54       56       351       8       4       6       38       68       32       10       17       46       89       1       4.42       7.32       16.67         51       50       52       232       2       3       16       35       38       11       1       4.44       7.40       11       4.44       27.32       16.67         49       48       50       238       1       7       18       52       22       5	59	58		60	200				17	39	33	13	42	36	16	3	1	3.12	13.14	8.33	
55       54       56       351       8       4       6       38       68       32       10       17       46       89       31       2       5.47       22.87       13.89         53       52       52       22.22       2       3       16       35       88       11       1       32       64       27       3       362       30.93       19.44         49       48       50       238       1       7       18       52       22       3       362       30.93       19.44         49       48       50       238       1       7       18       52       22       8       53       91       14       402       38.67       250.00         45       44       46       227       2       30       55       22       8       53       91       4.47       46.68       30.56         41       40       42       180       3       8       56       42       10       5       28       15       15       2.81       49.49       33.33         39       38       40       277       8       20       50       50	57	56		58	273	4		4	29	71	36	22	21	32	45	8	1	4.26	17.40	11.11	
53 $52$ $54$ $285$ $5$ $3$ $28$ $46$ $42$ $16$ $6$ $2$ $38$ $51$ $47$ $1$ $4.44$ $27.32$ $16.67$ $51$ $50$ $522$ $23$ $16$ $35$ $38$ $11$ $1$ $32$ $64$ $27$ $3$ $362$ $30.93$ $19.44$ $49$ $48$ $50$ $228$ $1$ $7$ $18$ $52$ $22$ $5$ $33$ $42$ $27$ $3662$ $30.9$ $16.67$ $25.00$ $45$ $44$ $46$ $227$ $2$ $30$ $56$ $21$ $12$ $8$ $361$ $42.20$ $27.78$ $43$ $42$ $44$ $273$ $8$ $20$ $50$ $52$ $44$ $40$ $41$ $28$ $41$ $40$ $41$ $80$ $42.20$ $27.78$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$ $33.33$	55	54		56	351	8	4	6	38	68	32	10	17	46	89	31	2	5.47	22.87	13.89	
51 $50$ $52$ $232$ $2$ $3$ $16$ $35$ $38$ $11$ $1$ $32$ $64$ $27$ $3$ $3.62$ $30.93$ $19.44$ $49$ $48$ $50$ $238$ $1$ $7$ $18$ $52$ $22$ $5$ $33$ $42$ $47$ $11$ $3.71$ $34.64$ $22.22$ $47$ $46$ $48$ $258$ $4$ $27$ $2$ $20$ $55$ $23$ $1$ $28$ $58$ $51$ $21$ $402$ $38.67$ $25.00$ $45$ $44$ $267$ $4$ $56$ $69$ $76$ $24$ $12$ $48$ $30$ $19$ $4.47$ $46.68$ $30.56$ $41$ $40$ $41$ $28$ $40$ $41$ $28$ $46$ $57.5$ $59.00$ $38.89$ $333$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $33$ $333$	53	52		54	285	5	3	28	46	42	16	6	2	38	51	47	1	4.44	27.32	16.67	
494850238171852225334247113.7134.6422.2247464825842745231285851214.0238.6725.004544462272230552285339163.5442.2027.7843424428745697624124830194.4746.6830.564140421803856421052615152.8149.4933.3339384027382050503244041284.2653.7436.11373638337242380462044160995.2559.0038.89333234313465053841069734.8867.8844.443130323605062719968915.6173.5047.2229281874532346224494933.3366.677262817968915.6173.947263.3966.67724<	51	50		52	232	2	3	16	35	38	11	1		32	64	27	3	3.62	30.93	19.44	
47 $46$ $48$ $258$ $4$ $27$ $45$ $23$ $1$ $28$ $58$ $51$ $21$ $4.02$ $38.67$ $25.00$ $45$ $44$ $46$ $227$ $2$ $2$ $30$ $55$ $22$ $8$ $63$ $39$ $16$ $3.54$ $42.20$ $27.78$ $43$ $42$ $44$ $287$ $4$ $5$ $69$ $76$ $24$ $12$ $48$ $30$ $19$ $4.47$ $46.68$ $30.56$ $41$ $40$ $42$ $180$ $3$ $8$ $56$ $42$ $10$ $526$ $15$ $15$ $2.81$ $49.49$ $33.33$ $39$ $38$ $40$ $273$ $8$ $20$ $50$ $50$ $32$ $4$ $40$ $41$ $28$ $4.26$ $53.74$ $36.11$ $37$ $36$ $38$ $337$ $24$ $23$ $80$ $46$ $20$ $4$ $41$ $60$ $39$ $5.25$ $59.00$ $38.89$ $35$ $34$ $313$ $46$ $50$ $57$ $8$ $4$ $10$ $69$ $73$ $48.86$ $67.88$ $44.44$ $31$ $30$ $32$ $366$ $50$ $62$ $71$ $9$ $9$ $68$ $91$ $5.61$ $73.50$ $47.22$ $29$ $28$ $22$ $44$ $79$ $45$ $12$ $4$ $49$ $65$ $46.50$ $78.14$ $65.56$ $23$ $22$ $24$ $32$ $33$ $7$ $7$ $53$ $2.81$ <	49	48		50	238	1	7	18	52	22	5			33	42	47	11	3.71	34.64	22.22	
4544462272230552285339163.5442.2027.7843424428745697624124830194.4746.6830.5641404218038564210526152.8149.4933.33393840273820505032440412842.6553.7436.11373638337242380462044160395.2559.0038.8935343625724313928111859474.0163.0041.6733323431465053841069734.8867.8844.4431303236060279968915.6173.5047.2229203029844794512449654.6576.1450.00272628187453234622449654.6576.1450.00272628187453077533.2384.2855.562322242620785	47	46		48	258		4	27	45	23	1			28	58	51	21	4.02	38.67	25.00	
43424428745697624124830194.4746.6830.564140421803856421052615152.8149.4933.3339384027382050503244041284.2653.7436.11373638337242380462044160395.2559.0038.8935343626724313928111859474.0163.0041.67333234365053841069734.8867.8844.443130323605062719968915.6173.5047.2229283029844794512449654.6578.1450.00272628187453234622449654.6578.1450.002726281874530771533.2384.2855.5623222412423077532.4291.7263.89212022180453077 <td>45</td> <td>44</td> <td></td> <td>46</td> <td>227</td> <td>2</td> <td>2</td> <td>30</td> <td>55</td> <td>22</td> <td></td> <td></td> <td></td> <td>8</td> <td>53</td> <td>39</td> <td>16</td> <td>3.54</td> <td>42.20</td> <td>27.78</td> <td></td>	45	44		46	227	2	2	30	55	22				8	53	39	16	3.54	42.20	27.78	
4140421803856421052615152.8149.4933.3339384027382050503244041284.2663.7436.11373638337242380462044160395.2569.0038.8935343625724313928111869474.0163.0041.673332343166053841069734.8867.8844.443130323605062719968915.6173.5047.2229283029844794512449654.6578.1450.00272628187453234622248055.5655.5623222414262243371232.2186.5068.332120221804545307532.8189.3061.1119182015537471711532.4291.7263.8917161810538337251.7695.1269.44 <trr< td=""><td>43</td><td>42</td><td></td><td>44</td><td>287</td><td>4</td><td>5</td><td>69</td><td>76</td><td>24</td><td></td><td></td><td></td><td>12</td><td>48</td><td>30</td><td>19</td><td>4.47</td><td>46.68</td><td>30.56</td><td></td></trr<>	43	42		44	287	4	5	69	76	24				12	48	30	19	4.47	46.68	30.56	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	41	40		42	180	З	8	56	42	10				5	26	15	15	2.81	49.49	33.33	
37 $36$ $38$ $337$ $24$ $23$ $80$ $46$ $20$ $4$ $41$ $60$ $39$ $5.25$ $59.00$ $38.89$ $35$ $34$ $36$ $257$ $24$ $31$ $39$ $28$ $11$ $18$ $59$ $47$ $4.01$ $63.00$ $41.67$ $33$ $32$ $34$ $313$ $46$ $50$ $53$ $8$ $4$ $10$ $69$ $73$ $4.88$ $67.88$ $44.44$ $31$ $30$ $32$ $360$ $50$ $62$ $71$ $9$ $9$ $68$ $91$ $5.61$ $73.50$ $47.22$ $29$ $28$ $30$ $298$ $44$ $79$ $45$ $12$ $4$ $49$ $65$ $4.65$ $78.14$ $50.00$ $27$ $26$ $28$ $187$ $45$ $32$ $34$ $6$ $222$ $48$ $2.92$ $81.46$ $52.78$ $25$ $24$ $26$ $207$ $85$ $28$ $28$ $13$ $53$ $3.23$ $84.28$ $55.56$ $23$ $22$ $24$ $142$ $62$ $24$ $32$ $-11$ $23$ $2.21$ $86.50$ $58.33$ $21$ $20$ $22$ $180$ $45$ $45$ $30$ $-77$ $53$ $2.81$ $89.30$ $61.11$ $19$ $18$ $20$ $155$ $37$ $47$ $17$ $-16$ $1$ $5$ $0.84$ $97.29$ $75.00$ $17$ $16$ $18$ $38$ $22$ $14$ $-5$ <td>39</td> <td>38</td> <td></td> <td>40</td> <td>273</td> <td>8</td> <td>20</td> <td>50</td> <td>50</td> <td>32</td> <td></td> <td></td> <td></td> <td>4</td> <td>40</td> <td>41</td> <td>28</td> <td>4.26</td> <td>53.74</td> <td>36.11</td> <td></td>	39	38		40	273	8	20	50	50	32				4	40	41	28	4.26	53.74	36.11	
35 $34$ $36$ $257$ $24$ $31$ $39$ $28$ $11$ $18$ $59$ $47$ $4.01$ $63.00$ $41.67$ $33$ $32$ $34$ $313$ $46$ $50$ $53$ $8$ $4$ $10$ $69$ $73$ $4.88$ $67.88$ $44.44$ $31$ $30$ $32$ $360$ $50$ $62$ $71$ $9$ $9$ $68$ $91$ $5.61$ $73.50$ $47.22$ $29$ $228$ $30$ $298$ $44$ $79$ $45$ $12$ $4$ $49$ $65$ $4.65$ $78.14$ $50.00$ $27$ $26$ $28$ $187$ $45$ $32$ $34$ $6$ $22$ $48$ $2.92$ $81.46$ $52.76$ $23$ $224$ $262$ $24$ $32$ $11$ $13$ $53$ $3.23$ $84.28$ $55.56$ $23$ $22$ $24$ $142$ $62$ $24$ $32$ $1$ $1$ $23$ $2.11$ $86.50$ $68.33$ $21$ $20$ $22$ $180$ $45$ $45$ $30$ $7$ $7$ $53$ $2.81$ $89.30$ $61.11$ $19$ $18$ $20$ $155$ $37$ $47$ $17$ $1$ $53$ $2.42$ $91.72$ $63.83$ $17$ $16$ $181$ $105$ $38$ $33$ $7$ $27$ $1.64$ $93.36$ $66.67$ $15$ $14$ $16$ $113$ $38$ $47$ $3$ $25$ $1.66$ $77.78$ $7$ <td< td=""><td>37</td><td>36</td><td></td><td>38</td><td>337</td><td>24</td><td>23</td><td>80</td><td>46</td><td>20</td><td></td><td></td><td></td><td>4</td><td>41</td><td>60</td><td>39</td><td>5.25</td><td>59.00</td><td>38.89</td><td></td></td<>	37	36		38	337	24	23	80	46	20				4	41	60	39	5.25	59.00	38.89	
333234313465053841069734.8867.8844.443130323605062719968915.6173.5047.2229283029844794512449654.6578.1450.00272628187453234622482.9281.4652.7623222414262282811233.2384.2655.562322241426224321232.2186.5058.332120221804545307532.8189.3061.111918201553747171532.4291.7263.8917161810538337271.6493.3666.6715141611338473251.7695.1269.441312148546221161.3396.4572.2211101254183150.8198.1077.7876838221420.5996.6980.565462117420.2799.	35	34		36	257	24	31	39	28	11					18	59	47	4.01	63.00	41.67	
3130323605062719968915.6173.5047.2229283029844794512449654.6578.1450.00272628187453234622482.9281.1652.7825242620785282813533.2384.2855.562322241426224321232.2186.5068.332120221804545307532.8189.3061.1119182015537471711532.4291.7263.8917161810538337271.6493.3666.6715141611338473251.7695.1269.441312148546221161.3396.4572.2211101254183150.8198.1077.7876838221420.2599.2786.111021714320.2599.2786.111021714320.2599.2786.1110 <td>33</td> <td>32</td> <td></td> <td>34</td> <td>313</td> <td>46</td> <td>50</td> <td>53</td> <td>8</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td>10</td> <td>69</td> <td>73</td> <td>4.88</td> <td>67.88</td> <td>44.44</td> <td></td>	33	32		34	313	46	50	53	8	4					10	69	73	4.88	67.88	44.44	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31	30		32	360	50	62	71	9						9	68	91	5.61	73.50	47.22	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	29	28		30	298	44	79	45	12						4	49	65	4.65	78.14	50.00	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	27	26		28	187	45	32	34	6							22	48	2.92	81.46	52.78	i.
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	25	24		26	207	85	28	28								13	53	3.23	84.28	55.56	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	23	22		24	142	62	24	32								1	23	2.21	86.50	58.33	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	21	20		22	180	45	45	30								7	53	2.81	89.30	61,11	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	19	18		20	155	37	47	17								1	53	2.42	91.72	63.89	
15141611338473251.7695.12 $69.44$ 1312148546221161.33 $96.45$ $72.22$ 11101254183150.84 $97.29$ $75.00$ 981052212650.8198.10 $77.78$ 76838221420.5998.69 $80.56$ 546211740.33 $99.02$ $83.33$ 324161240.25 $99.27$ $86.11$ 102171430.27 $99.53$ $88.89$ -1-2013940.20 $99.73$ $91.67$ -3-4-213670.06100.00 $97.22$ -7-8-6-4440.06100.00 $97.22$	17	16		18	105	38	33	7									27	1.64	93.36	66.67	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	15	14		16	113	38	47	3									25	1.76	95.12	69.44	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	13	12		14	85	46	22	1									16	1.33	96.45	72.22	
9       8       10       52       21       26       5       0.81       98.10       77.78         7       6       8       38       22       14       2       0.59       98.69       80.56         5       4       6       21       17       4       0.33       99.02       83.33         3       2       4       16       12       4       0.25       99.27       86.11         1       0       2       17       14       3       0.27       99.53       88.89         -1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.06       100.00       97.22         -7       -8       -6       -6       4       4       0.06       100.00       97.22	11	10		12	54	18	31										5	0.84	97.29	75.00	
7       6       8       38       22       14       2       0.59       98.69       80.56         5       4       6       21       17       4       0.33       99.02       83.33         3       2       4       16       12       4       0.25       99.27       86.11         1       0       2       17       14       3       0.27       99.53       88.89         -1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.00       90.00       97.22         -7       -8       -6       -4       4       4       0.00       100.00       97.22	9	8		10	52	21	26										5	0.81	98.10	77.78	
5       4       6       21       17       4       0.33       99.02       83.33         3       2       4       16       12       4       0.25       99.27       86.11         1       0       2       17       14       3       0.27       99.53       88.89         -1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.20       99.94       94.44         -5       -6       -4       4       4       0.00       97.22         -7       -8       -6       0.00       100.00       100.00       100.00	7	6		8	38	22	14										2	0.59	98.69	80.56	
3       2       4       16       12       4       0.25       99.27       86.11         1       0       2       17       14       3       0.27       99.53       88.89         -1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.20       99.94       94.44         -5       -6       -4       4       4       0.06       100.00       97.22         -7       -8       -6       0.00       100.00       100.00       100.00	5	4		6	21	17	4											0.33	99.02	83.33	
1       0       2       17       14       3       0.27       99.53       88.89         -1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.20       99.94       94.44         -5       -6       -4       4       4       0.06       100.00       97.22         -7       -8       -6       0.00       100.00       100.00       100.00	3	2		4	16	12	4											0.25	99.27	86.11	
-1       -2       0       13       9       4       0.20       99.73       91.67         -3       -4       -2       13       6       7       0.20       99.94       94.44         -5       -6       -4       4       4       0.06       100.00       97.22         -7       -8       -6       0.00       100.00       100.00       100.00	1	0		2	17	14	3											0.27	99.53	88.89	
-3       -4       -2       13       6       7       0.20       99.94       94.44         -5       -6       -4       4       4       0.06       100.00       97.22         -7       -8       -6       0.00       100.00       100.00       100.00	-1	-2		0	13	9	4											0.20	99.73	91.67	
-5         -6         -4         4         4         0.06         100.00         97.22           -7         -8         -6         0.00         100.00         100.00	-3	-4		-2	13	6	7											0.20	99.94	94.44	
-7 -8 -6 0.00 100.00 100.00	-5	-6		-4	4	4												0.06	100.00	97.22	
	-7	-8		-6														0.00	100.00	100.00	

78.14% of Heating Season Can Use Condensing Temperatures in Wilkes-Barre

Wilkes-Barre, PA





### Source:

http://www.weatherdatadepot.com/



Source: http://www.weatherdatadepot.com/

# **TERMINAL UNITS: BASEBOARD**

																	$\searrow$
		Fins			Steam 1 PSI*	HOT WATER RATINGS* BTU/HR./FT.											
Tube Size & Material	Fin Size & Material	Per Foot	Water Flow	Pressure Drop †	Btu/Hr. Per Foot	110°F	120°F	130°F	140°F	150°F	160°F	170°F	180°F	190°F	200°F	210°F	220°F
3/4 copper	"3" x 3¼" x .024 aluminum	48	1 GPM 4 GPM	47 525		230 250	310 330	390 410	480 500	570 600	670 700	770 810	870 920	980 1040	1080 1140	1200 1260	1320 1400
3/4" copper	2¾" x 2½" x .011" aluminum	55	1 GPM 4 GPM	47 525	_	210 230	290 300	360 380	440 460	520 550	610 650	710 750	800 850	900 960	1000 1060	1100 1170	1220 1290
1" copper	3" x 2½" x .011" aluminum	48	1 GPM 4 GPM	13 145	_	210 230	290 300	360 380	440 460	520 550	610 650	710 750	800 850	900 960	1000 1060	1100 1170	1220 1290
1-1/4" copper	3" x 3¼" x .020" aluminum	48	1 GPM 4 GPM	6 63	1160	220 230	300 310	370 390	450 480	540 570	640 670	730 780	830 880	940 990	1040 1100	1140 1210	1260 1340
1-1/4" IPS steel	3" x 3¼" x .028 aluminized steel	48	1 GPM 4 GPM	3 41	980	190 200	250 270	320 340	390 410	460 490	550 580	630 670	710 750	810 850	890 940	980 1040	1080 1150

NOTE: Approximately 50% Reduction in Heating Capacity from 140°F to 110°F

# HYBRID BOILER SYSTEM ESSENTIALS

### □ Heat Pump(s) <u>MUST</u> be upstream of boiler(s).

- Prioritizes electrified equipment
- ✓ Optimizes performance
- Control system's temperature sensor <u>MUST</u> be downstream of all appliances in order to measure their contribution to the heating system.
- **Control system <u>MUST</u> prioritize the heat pump(s)**.
- Control system <u>MUST</u> protect the heat pumps from high incoming (return) water temperatures.
- □ Tune the ODA reset curve for the lowest possible operating temperatures throughout the year based on terminal unit capacities.



# HEAT PUMP WITH LOW LOSS HEADER



# HEAT PUMP FOR DHW APPLICATION



# HYBRID BOILER SYSTEM PERKS



### Minimize first cost & installation cost by reusing operable equipment:

- Keep existing operable boilers for backup and redundancy
- Install heat pumps for priority operation and carbon reduction goals

### **Opportunities for dual fuel operation / interruptible service:**

- Heat Pumps: Electric
- ✓ Boilers: Natural Gas, Propane Gas, Fuel Oil

### **Achieve higher system** $\Delta T \rightarrow Lower return temperatures$

- More condensing opportunities throughout the heating season
- Requires relatively simple installation methods with significant fuel savings – excellent ROI potential!

# PK Heat Pump EvoHP HP700

### Compact External Rotor DC Motors

High-performance compact external rotor DC motors and integrated design help to maintain low noise and high efficiency.

### Large Type C Finned Heat Exchanger

The fins adopt anti-frost coating and corrugated edge spoilers to further enhance the effect of spoilers at strong wind side, which improves heat transfer coefficient, extends frost-free operation time by more than 50% and improves COP.



# PK Heat Pump EvoHP

### Wide Operating Range

- Equipped with multiple technologies to improve stability and reliability, aiding with extreme temperature challenges and stable operation.
- Min operating ambient temp:
  - -32 F
- Max operating ambient temp:
  - 131F





P-K EvoHP Operating Range

# PK Heat Pump EvoHP

HEAT PUMP RATINGS	HP700	HEAT PUMP RATINGS	HP700		
EFFICIENCY (CoP)	3.71	INDOOR/OUTDOOR	OUTDOOR		
	(371%)	TURNDOWN	4:1		
REFRIGERANT	R410A	EUE	FC		
MAX BTU/HR INPUT	249,415	EC=ELECTRIC	EÇ		
	70.1	DEPTH (IN / MM)	137/3480		
MAX KW INPUT	(3.1	WIDTH (IN / MM)	52.4/1330		
MAX BTU/HR OUTPUT	853,000	HEIGHT (IN / MM)	92.9 / 2360		
MAX KW OUTPUT	250	SHIPPING WEIGHT	2508/1140		
MIN FLOW @ IGNITION (GPM)	85.3		440,40004		
MIN FLOW @ IGNITION (LITRES/SEC)	5.4	REQUIREMENTS	3ph 60hz 167 amps		
MIN BTU/HR INPUT	62,354	OPERATING WEIGHT (LBS/KILOS)	2508/1104		
MIN KW INPUT	18.3	FLW RATE 20°F AT GPM	252/54		
MIN BTU/HR OUTPUT	213,250	(LT/SEC)	00.07 0.4		
MIN KW OUTPUT	62.5				

