



## **High Efficiency Water-to-Water Heat Pumps**

### **Ice Rink Series**



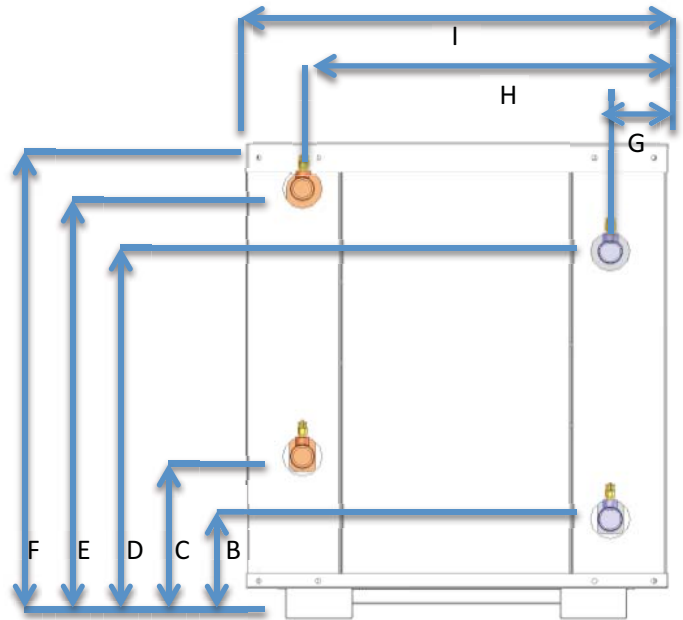
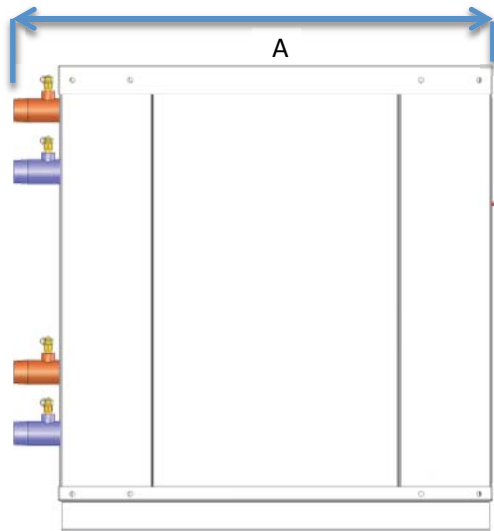
### **Product Specifications**

**KS 288 IR ■ KS 450 IR**




### KS 288 IR Dimensions

A	33.5"/ 851mm	F	32.125"/ 816mm
B	6.75"/ 171mm	G	3.75"/ 95mm
C	11"/ 279mm	H	24"/ 610mm
D	24.875"/ 632mm	I	28.5"/ 718mm
E	29.125"/ 740mm		
Weight	625lbs/ 283kg	Connection Size	1.5" MPT



### KS 288 IR Electrical Specifications

Heat Pump Only					Heat Pump with 2 Circulation Pumps				
Voltage/Phase /Hz	Compressor		Heat Pump FLA	Minimum Circuit Ampacity	Maximum Fuse Size	Circ Pumps 2 per unit FLA	Unit Total FLA	Minimum Circuit Ampacity	Maximum Fuse Size
	RLA	LRA							
208-230/3/60	57.6	342	57.6	72.0	120	13.2	70.8	85.2	140
460/3/60	27.6	155	27.6	34.5	60	6.0	33.6	40.5	60
575/3/60	22.0	115	22.0	27.5	45	4.8	26.8	32.3	50

<b>KS 288 Ice Rink Series</b>	<b>KS 288 IR Specifications</b>	Date: 21/12/2012	 Suite 114 – 11 Morris Drive Dartmouth, NS B3B 1M2 P: 902-481-2398 F: 902-481-2426
		Rev: 19	
		Project:	

# Engineering Guide Specifications (Model KS 288 IR)

**General** The liquid source water-to-water heat pump shall be a single packaged non-reversing heating/cooling unit. The unit shall be listed by a nationally recognized safety testing laboratory or agency, such as ETL. Testing shall be equal to CSA C22-2 or UL 427. The KS ice rink liquid source water-to-water heat pump unit as manufactured by Kube Solutions of Dartmouth, NS, shall be designed to operate with evaporator entering liquid temperatures between 10°F(-12°C) and 70°F(21°C), and condenser entering liquid temperatures between 50°F(10°C) and 100°F(38°C). The evaporator entering fluid temperature must be lower than the condenser entering fluid temperature. Each unit shall be run-tested at the factory.

**Casing and Cabinet** The cabinet shall be fabricated from heavy gauge stainless steel. The cabinet shall have removable access doors on all four sides, and a hinged access door over the electrical cabinet. The interior shall be insulated with ½” thick multi-density, coated glass fiber, with edges sealed or tucked under flanges. All units shall have 7/8” and 1 1/8” knockouts for entrance of low and high voltage wiring. Cabinet dimensions shall be less than 31” in width or depth to permit units to be easily moved through a standard size door.

**Refrigerant Circuit** All units shall contain a sealed R410a refrigerant circuit including a hermetic motor-compressor, electronic thermal expansion valve, two (2) stainless steel brazed plate type heat exchangers, factory installed high and low pressure lockout switches and service ports, and a liquid line filter-drier. Low-pressure lockout switch shall be electrical reset with interruption to power supply. High-pressure lockout switch shall be manual reset.

Compressor shall be designed for refrigeration duty, with internal isolation and mounted on rubber vibration isolators. Compressor shall be manufactured with oil-sight glass. Compressor motor shall have internal motor protection and shall be single-phase PSC type or 3 phase. Compressor shall be designed for use with R410a refrigerant.

Copper piping connecting compressor to refrigerant circuit shall include piping to eliminate harmonic vibration.

The liquid to refrigerant heat exchangers shall be brazed plate type constructed with type 316 stainless steel plates and brazed with copper. The fluid-to-refrigerant condenser shall be designed for operation from -321°F to 350°F, and be capable of withstanding 650 PSIG working pressure on liquid and refrigerant sides. The fluid-to-refrigerant evaporator shall be designed for operation from -321°F to 350°F, and be capable of withstanding 450 PSIG working pressure on liquid and refrigerant sides. Heat exchangers shall be manufactured with built in refrigerant distributor tube with calibrated orifices to distribute gas evenly throughout heat exchanger, and be designed for use with R410a refrigerant.

Refrigerant circuit shall include an electronic TX valve to prevent liquid refrigerant migration to the evaporator. The electronic thermal expansion valve assembly shall provide proper superheat over the liquid temperature range with minimal “hunting”. The electronic thermal expansion valve shall be designed for single direction refrigerant flow. Bi-directional valves shall not be permitted. Externally mounted pressure controlled water regulating flow valves are not acceptable. The fluid-to-refrigerant evaporator and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures.

All refrigerant piping on suction side of compressor shall be insulated with ½” closed-cell foam insulation to prevent condensation. Evaporator shall be insulated with ½” closed cell insulation to prevent condensation. Refrigerant piping shall be clamped and supported to minimize vibration and stress cracking.

Each unit shall be factory run-tested for a minimum of two hours under actual load conditions. A copy of the run test shall include:


- Amperage and voltage draw
- Refrigerant pressures
- Sight glass status
- Operation & verification of high & low pressure controls
- Entering and leaving fluid temperatures for condenser and evaporator
- Entering and leaving fluid pressures for condenser and evaporator
- Superheat measurement
- Operation of compressor overload protection

A copy of the run-test shall be included in the installation manual shipped with the unit and a copy shall be maintained at the factory.

**Electrical** - Controls and safety devices will be factory wired and mounted within the unit. Controls shall include compressor contactor, 24 VAC, 100 VA transformer, phase protection, anti-rotation protection and fused control circuit. Electrical circuit shall include red fault light indicator light and green running indicator light on outside of cabinet, and shall include an “on-off-auto” selector switch mounted inside the electrical cabinet.

**Piping** - All supply and return liquid connections shall be MPT flush-mounted stainless steel threaded fittings, sizes indicated on unit specification sheet. Pressure/temperature ports shall be included on both condenser and evaporator fluid inlets and outlets.

**Optional Mounting Rack** - Unit(s) can be mounted on welded rack supplied by the manufacturer.

<b>KS 288 Ice Rink Series</b>	<b>Written Specifications</b>	Date: 21/12/2012	 Suite 114 – 11 Morris Drive Dartmouth, NS B3B 1M2 P: 902-481-2398 F: 902-481-2426
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**KS288 Performance Data Heating**

SOURCE Evaporator					LOAD Condenser						
EWT (F)	LWT (F)	Extract Heat (MBtuH)	Pressure Drop (psig)	Pressure Drop (ft)	EWT (F)	Heating Capacity (MBtuH)	Power (kW)	LWT (F)	COP	Pressure Drop (psig)	Pressure Drop (ft)
10	6.3	93.6	9.47	21.9	50	124.7	8.0	54.1	4.6	17.94	41.4
	6.5	89.8	9.46	21.9	60	123.1	8.9	64.2	4.1	17.71	40.9
	6.7	85.5	9.44	21.8	70	122.0	9.9	74.3	3.6	17.44	40.3
	6.8	81.1	9.40	21.7	80	121.2	11.0	83.4	3.2	17.17	39.7
	7.0	75.9	9.35	21.6	90	120.9	12.3	93.5	2.9	16.84	38.9
	7.3	70.0	9.29	21.5	100	120.5	13.9	103.6	2.5	16.47	38.0
7.5	63.7	9.21	21.3	110	120.7	15.6	113.8	2.3	16.07	37.1	
20	15.8	115.8	9.70	22.4	50	149.1	8.3	54.9	5.2	17.11	39.5
	16.0	110.2	9.73	22.5	60	145.6	9.1	64.9	4.7	16.86	38.9
	16.2	104.6	9.73	22.5	70	142.9	10.1	75.0	4.1	16.59	38.3
	16.4	99.1	9.72	22.5	80	140.8	11.1	84.0	3.7	16.31	37.7
	16.6	92.8	9.69	22.4	90	139.2	12.5	94.1	3.3	15.97	36.9
	16.9	85.2	9.67	22.3	100	137.0	14.0	104.1	2.9	15.59	36.0
17.1	77.5	9.62	22.2	110	135.5	15.6	114.2	2.5	15.18	35.1	
17.4	69.7	9.55	22.1	120	134.9	17.5	124.3	2.3	14.73	34.0	
30	25.1	140.9	9.82	22.7	50	176.6	8.7	55.8	5.9	16.52	38.1
	25.3	134.1	9.88	22.8	60	171.7	9.5	65.7	5.3	16.26	37.6
	25.6	127.1	9.91	22.9	70	167.4	10.4	75.7	4.7	15.98	36.9
	25.8	120.4	9.93	22.9	80	163.9	11.4	84.7	4.2	15.69	36.2
	26.1	112.7	9.93	22.9	90	160.5	12.7	94.8	3.7	15.34	35.4
	26.4	103.9	9.93	22.9	100	156.9	14.1	104.8	3.3	14.95	34.5
	26.7	94.8	9.91	22.9	110	153.9	15.8	114.8	2.9	14.52	33.5
	27.0	85.5	9.87	22.8	120	151.5	17.6	124.9	2.5	14.06	32.5
27.4	75.1	9.83	22.7	130	148.9	19.6	134.9	2.2	13.57	31.3	
40	34.4	169.1	9.83	22.7	50	207.1	9.2	56.7	6.6	16.16	37.3
	34.7	161.2	9.90	22.9	60	200.9	9.9	66.7	6.0	15.90	36.7
	34.9	152.9	9.97	23.0	70	195.0	10.8	76.6	5.3	15.60	36.0
	35.2	144.9	10.01	23.1	80	190.1	11.7	85.6	4.8	15.31	35.4
	35.5	135.6	10.04	23.2	90	184.9	13.0	95.5	4.2	14.94	34.5
	35.9	125.6	10.07	23.3	100	180.0	14.4	105.5	3.7	14.54	33.6
	36.2	115.2	10.08	23.3	110	175.4	16.0	115.5	3.2	14.11	32.6
	36.6	104.4	10.07	23.3	120	171.2	17.7	125.5	2.8	13.64	31.5
	37.0	92.9	10.06	23.2	130	167.3	19.7	135.5	2.5	13.13	30.3
37.2	87.0	10.04	23.2	135	165.4	20.7	140.5	2.3	12.87	29.7	
50	43.9	191.7	9.81	22.6	60	233.4	10.4	67.7	6.6	15.81	36.5
	44.2	182.0	9.90	22.9	70	226.0	11.2	77.6	5.9	15.51	35.8
	44.5	172.8	9.97	23.0	80	219.6	12.1	86.5	5.3	15.20	35.1
	44.9	162.4	10.02	23.1	90	213.3	13.3	96.4	4.7	14.83	34.2
	45.3	150.8	10.08	23.3	100	206.4	14.7	106.3	4.1	14.41	33.3
	45.6	139.0	10.12	23.4	110	200.3	16.2	116.2	3.6	13.96	32.3
	46.0	127.1	10.14	23.4	120	194.9	18.0	126.2	3.2	13.49	31.1
	46.5	114.0	10.16	23.5	130	189.0	19.9	136.1	2.8	12.97	29.9
46.7	107.6	10.16	23.5	135	186.6	20.9	141.1	2.6	12.70	29.3	
60	53.1	202.8	9.72	22.4	70	259.1	11.7	78.6	6.5	15.64	36.1
	53.4	191.1	9.81	22.7	80	251.4	12.6	87.5	5.9	15.32	35.4
	53.8	178.2	9.90	22.9	90	243.5	13.8	97.3	5.2	14.94	34.5
	54.2	165.2	9.98	23.1	100	235.1	15.1	107.2	4.6	14.51	33.5
	54.6	151.9	10.05	23.2	110	227.5	16.6	117.1	4.0	14.05	32.5
	55.1	137.5	10.09	23.3	120	220.6	18.3	127.0	3.5	13.57	31.3
	55.5	130.3	10.14	23.4	130	213.2	20.1	136.9	3.1	13.03	30.1
55.8	273.0	10.15	23.5	135	209.9	21.1	141.8	2.9	12.76	29.5	
70	62.6	237.1	9.54	22.0	80	287.5	13.1	88.6	6.4	15.68	36.2
	63.0	223.8	9.66	22.3	90	277.8	14.3	98.4	5.7	15.28	35.3
	63.5	209.9	9.76	22.6	100	268.2	15.5	108.2	5.1	14.85	34.3
	63.9	195.5	9.86	22.8	110	259.0	17.0	118.1	4.5	14.38	33.2
	64.4	180.6	9.94	23.0	120	250.2	18.6	127.9	3.9	13.88	32.1
	64.9	165.1	10.01	23.1	130	241.5	20.5	137.7	3.5	13.34	30.8
65.2	157.1	10.04	23.2	135	237.3	21.4	142.7	3.2	13.06	30.2	



- For operations outside this table contact the manufacturer
- Interpolation is permissible, extrapolation is not
- Antifreeze may be required at some operating temperatures to prevent freezing
- The fluid entering the unit must pass through a straining/ filtering device
- As a result of further research and development specifications are subject to improvements without notice
- Data normalized to water, correction factors for antifreeze required where applicable
- 3rd party tested
- for 50Hz operation deduct 16.7% from the capacity

**KS288 Performance Data Cooling**

SOURCE Condenser						LOAD Evaporator						
EWT (F)	LWT (F)	Reject Heat (MBtuH)	Power (kW)	Pressure Drop (psig)	Pressure Drop (ft)	EWT (F)	Cooling Capacity (MBtuH)	Cooling Capacity (Tons)	LWT (F)	EER	Pressure Drop (psig)	Pressure Drop (ft)
50	57.9	124.7	8.0	17.94	41.4	10	93.6	7.3	6.3	11.7	9.47	21.9
	58.8	123.1	8.3	17.11	39.5	20	115.8	9.0	15.8	13.9	9.70	22.4
	59.7	122.0	8.7	16.52	38.1	30	140.9	11.0	25.1	16.2	9.82	22.7
	60.7	121.2	9.2	16.16	37.3	40	169.1	13.2	34.4	18.5	9.83	22.7
60	68.7	123.1	8.9	17.71	40.9	10	89.8	7.0	6.5	10.1	9.46	21.9
	69.5	145.6	9.1	16.86	38.9	20	110.2	8.6	16.0	12.1	9.73	22.5
	70.3	171.7	9.5	16.26	37.6	30	134.1	10.4	25.3	14.2	9.88	22.8
	71.3	200.9	9.9	15.90	36.7	40	161.2	12.6	34.7	16.3	9.90	22.9
72.4	233.4	10.4	15.81	36.5	50	191.7	14.9	43.9	18.5	9.81	22.6	
70	79.5	122.0	9.9	17.44	40.3	10	85.5	6.7	6.7	8.6	9.44	21.8
	80.2	142.9	10.1	16.59	38.3	20	104.6	8.1	16.2	10.4	9.73	22.5
	81.0	167.4	10.4	15.98	36.9	30	127.1	9.9	25.6	12.2	9.91	22.9
	82.0	195.0	10.8	15.60	36.0	40	152.9	11.9	34.9	14.2	9.97	23.0
	83.0	226.0	11.2	15.51	35.8	50	182.0	14.2	44.2	16.2	9.90	22.9
84.1	259.1	11.7	15.64	36.1	60	213.1	16.6	53.1	18.2	9.72	22.4	
80	89.2	121.2	11.0	17.17	39.7	10	81.1	6.3	6.8	7.4	9.40	21.7
	89.9	140.8	11.1	16.31	37.7	20	99.1	7.7	16.4	8.9	9.72	22.5
	90.7	163.9	11.4	15.69	36.2	30	120.4	9.4	25.8	10.6	9.93	22.9
	91.5	190.1	11.7	15.31	35.4	40	144.9	11.3	35.2	12.4	10.01	23.1
	92.5	219.6	12.1	15.20	35.1	50	172.8	13.5	44.5	14.2	9.97	23.0
	93.6	251.4	12.6	15.32	35.4	60	202.8	15.8	53.4	16.1	9.81	22.7
94.8	287.5	13.1	15.68	36.2	70	237.1	18.5	62.6	18.0	9.54	22.0	
90	100.1	120.9	12.3	16.84	38.9	10	75.9	5.9	7.0	6.2	9.35	21.6
	100.7	139.2	12.5	15.97	36.9	20	92.8	7.2	16.6	7.4	9.69	22.4
	101.4	160.5	12.7	15.34	35.4	30	112.7	8.8	26.1	8.9	9.93	22.9
	102.2	184.9	13.0	14.94	34.5	40	135.6	10.6	35.5	10.5	10.04	23.2
	103.1	213.3	13.3	14.83	34.2	50	162.4	12.6	44.9	12.2	10.02	23.1
	104.2	243.5	13.8	14.94	34.5	60	191.1	14.9	53.8	13.9	9.90	22.9
105.3	277.8	14.3	15.28	35.3	70	223.8	17.4	63.0	15.7	9.66	22.3	
100	110.9	120.5	13.9	16.47	38.0	10	70.0	5.5	7.3	5.1	9.29	21.5
	111.4	137.0	14.0	15.59	36.0	20	85.2	6.6	16.9	6.1	9.67	22.3
	112.1	156.9	14.1	14.95	34.5	30	103.9	8.1	26.4	7.4	9.93	22.9
	112.9	180.0	14.4	14.54	33.6	40	125.6	9.8	35.9	8.7	10.07	23.3
	113.7	206.4	14.7	14.41	33.3	50	150.8	11.7	45.3	10.3	10.08	23.3
	114.7	235.1	15.1	14.51	33.5	60	178.2	13.9	54.2	11.8	9.98	23.1
115.8	268.2	15.5	14.85	34.3	70	209.9	16.3	63.5	13.5	9.76	22.6	
110	121.7	120.7	15.6	16.07	37.1	10	63.7	5.0	7.5	4.1	9.21	21.3
	122.2	135.5	15.6	15.18	35.1	20	77.5	6.0	17.1	5.0	9.62	22.2
	122.8	153.9	15.8	14.52	33.5	30	94.8	7.4	26.7	6.0	9.91	22.9
	123.5	175.4	16.0	14.11	32.6	40	115.2	9.0	36.2	7.2	10.08	23.3
	124.4	200.3	16.2	13.96	32.3	50	139.0	10.8	45.6	8.6	10.12	23.4
	125.3	227.5	16.6	14.05	32.5	60	165.2	12.9	54.6	10.0	10.05	23.2
126.3	259.0	17.0	14.38	33.2	70	195.5	15.2	63.9	11.5	9.86	22.8	
120	133.0	134.9	17.5	14.73	34.0	20	69.7	5.4	17.4	4.0	9.55	22.1
	133.6	151.5	17.6	14.06	32.5	30	85.5	6.7	27.0	4.9	9.87	22.8
	134.2	171.2	17.7	13.64	31.5	40	104.4	8.1	36.6	5.9	10.07	23.3
	135.0	194.9	18.0	13.49	31.1	50	127.1	9.9	46.0	7.1	10.14	23.4
	135.9	220.6	18.3	13.57	31.3	60	151.9	11.8	55.1	8.3	10.09	23.3
	136.8	250.2	18.6	13.88	32.1	70	180.6	14.1	64.4	9.7	9.94	23.0
130	144.3	148.9	19.6	13.57	31.3	30	75.1	5.9	27.4	3.8	9.83	22.7
	144.9	167.3	19.7	13.13	30.3	40	92.9	7.2	37.0	4.7	10.06	23.2
	145.7	189.0	19.9	12.97	29.9	50	114.0	8.9	46.5	5.7	10.16	23.5
	146.5	213.2	20.1	13.03	30.1	60	137.5	10.7	55.5	6.8	10.14	23.4
147.4	241.5	20.5	13.34	30.8	70	165.1	12.9	64.9	8.1	10.01	23.1	
135	150.3	165.4	20.7	12.87	29.7	40	87.0	6.8	37.2	4.2	10.04	23.2
	151.0	186.6	20.9	12.70	29.3	50	107.6	8.4	46.7	5.2	10.16	23.5
	151.8	209.9	21.1	12.76	29.5	60	130.3	10.2	55.8	6.2	10.15	23.5
152.7	237.3	21.4	13.06	30.2	70	157.1	12.2	65.2	7.3	10.04	23.2	



- For operations outside this table contact the manufacturer

- Interpolation is permissible, extrapolation is not

- Antifreeze may be required at some operating temperatures to prevent freezing

- The fluid entering the unit must pass through a straining/ filtering device

- As a result of further research and development specifications are subject to improvements without notice

- Data normalized to water, correction factors for antifreeze required where applicable

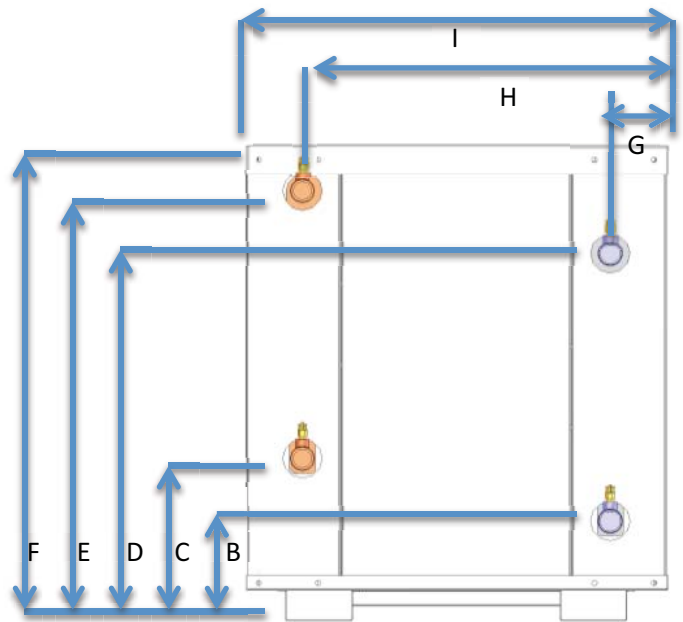
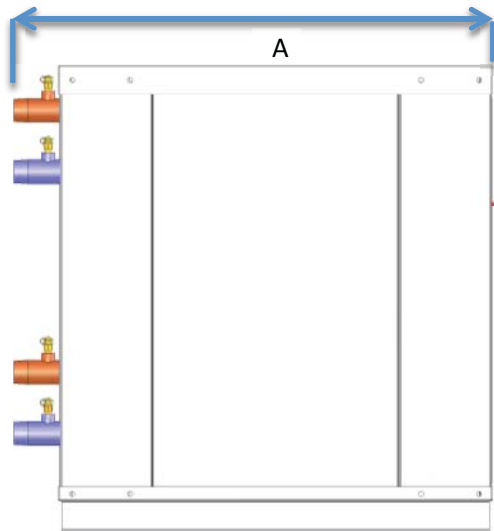
- 3rd party tested

- for 50Hz operation deduct 16.7% from the capacity



### KS 450 IR Dimensions

A	33.5"/ 851mm	F	32.125"/ 816mm
B	6.75"/ 171mm	G	3.75"/ 95mm
C	11"/ 279mm	H	24"/ 610mm
D	24.875"/ 632mm	I	28.5"/ 718mm
E	29.125"/ 740mm		
Weight	935lbs/ 424kg	Connection Size	2.0" MPT



### KS450IR Electrical Specifications

Heat Pump Only					Heat Pump with 2 Circulation Pumps				
Voltage/Phase /Hz	Compressor		Heat Pump FLA	Minimum Circuit Ampacity	Maximum Fuse Size	Circ Pumps 2 per unit FLA	Unit Total FLA	Minimum Circuit Ampacity	Maximum Fuse Size
	RLA	LRA							
208-230/3/60	-	-	-	-	-	-	-	-	-
460/3/60	35.8	290	35.8	44.8	80	6.8	42.6	51.6	80
575/3/60	32.8	255	32.8	41.0	70	5.4	38.2	46.4	70

<b>KS 450 Ice Rink Series</b>	<b>KS 450 IR Specifications</b>	Date: 21/012/2012	 Suite 114 – 11 Morris Drive Dartmouth, NS B3B 1M2 P: 902-481-2398 F: 902-481-2426
		Rev: 19	
		Project:	

# Engineering Guide Specifications (Model KS 450 IR)

**General** The liquid source water-to-water heat pump shall be a single packaged non-reversing heating/cooling unit. The unit shall be listed by a nationally recognized safety testing laboratory or agency, such as ETL. Testing shall be equal to CSA C22-2 or UL 427. The KS ice rink liquid source water-to-water heat pump unit as manufactured by Kube Solutions of Dartmouth, NS, shall be designed to operate with evaporator entering liquid temperatures between 10°F(-12°C) and 70°F(21°C), and condenser entering liquid temperatures between 50°F(10°C) and 100°F(38°C). The evaporator entering fluid temperature must be lower than the condenser entering fluid temperature. Each unit shall be run-tested at the factory.

**Casing and Cabinet** The cabinet shall be fabricated from heavy gauge stainless steel. The cabinet shall have removable access doors on all four sides, and a hinged access door over the electrical cabinet. The interior shall be insulated with ½” thick multi-density, coated glass fiber, with edges sealed or tucked under flanges. All units shall have 7/8” and 1 1/8” knockouts for entrance of low and high voltage wiring. Cabinet dimensions shall be less than 31” in width or depth to permit units to be easily moved through a standard size door.

**Refrigerant Circuit** All units shall contain a sealed R410a refrigerant circuit including a hermetic motor-compressor, electronic thermal expansion valve, two (2) stainless steel brazed plate type heat exchangers, factory installed high and low pressure lockout switches and service ports, and a liquid line filter-drier. Low-pressure lockout switch shall be electrical reset with interruption to power supply. High-pressure lockout switch shall be manual reset.

Compressor shall be designed for refrigeration duty, with internal isolation and mounted on rubber vibration isolators. Compressor shall be manufactured with oil-sight glass. Compressor motor shall have internal motor protection and shall be single-phase PSC type or 3 phase. Compressor shall be designed for use with R410a refrigerant.

Copper piping connecting compressor to refrigerant circuit shall include piping to eliminate harmonic vibration.

The liquid to refrigerant heat exchangers shall be brazed plate type constructed with type 316 stainless steel plates and brazed with copper. The fluid-to-refrigerant condenser shall be designed for operation from -321°F to 350°F, and be capable of withstanding 650 PSIG working pressure on liquid and refrigerant sides. The fluid-to-refrigerant evaporator shall be designed for operation from -321°F to 350°F, and be capable of withstanding 450 PSIG working pressure on liquid and refrigerant sides. Heat exchangers shall be manufactured with built in refrigerant distributor tube with calibrated orifices to distribute gas evenly throughout heat exchanger, and be designed for use with R410a refrigerant.

Refrigerant circuit shall include an electronic TX valve to prevent liquid refrigerant migration to the evaporator. The electronic thermal expansion valve assembly shall provide proper superheat over the liquid temperature range with minimal “hunting”. The electronic thermal expansion valve shall be designed for single direction refrigerant flow. Bi-directional valves shall not be permitted. Externally mounted pressure controlled water regulating flow valves are not acceptable. The fluid-to-refrigerant evaporator and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures.

All refrigerant piping on suction side of compressor shall be insulated with ½” closed-cell foam insulation to prevent condensation. Evaporator shall be insulated with ½” closed cell insulation to prevent condensation. Refrigerant piping shall be clamped and supported to minimize vibration and stress cracking.

Each unit shall be factory run-tested for a minimum of two hours under actual load conditions. A copy of the run test shall include:


- Amperage and voltage draw
- Refrigerant pressures
- Sight glass status
- Operation & verification of high & low pressure controls
- Entering and leaving fluid temperatures for condenser and evaporator
- Entering and leaving fluid pressures for condenser and evaporator
- Superheat measurement
- Operation of compressor overload protection

A copy of the run-test shall be included in the installation manual shipped with the unit and a copy shall be maintained at the factory.

**Electrical** - Controls and safety devices will be factory wired and mounted within the unit. Controls shall include compressor contactor, 24 VAC, 100 VA transformer, phase protection, anti-rotation protection and fused control circuit. Electrical circuit shall include red fault light indicator light and green running indicator light on outside of cabinet, and shall include an “on-off-auto” selector switch mounted inside the electrical cabinet.

**Piping** - All supply and return liquid connections shall be MPT flush-mounted stainless steel threaded fittings, sizes indicated on unit specification sheet. Pressure/temperature ports shall be included on both condenser and evaporator fluid inlets and outlets.

**Optional Mounting Rack** - Unit(s) can be mounted on welded rack supplied by the manufacturer.

<b>KS 450 Ice Rink Series</b>	<b>Written Specifications</b>	Date: 21/12/2012	
		Rev: 19	
		Project:	
		Suite 114 – 11 Morris Drive Dartmouth, NS B3B 1M2 P: 902-481-2398 F: 902-481-2426	

**KS450 Performance Data Heating**

SOURCE Evaporator					LOAD Condenser						
EWT (F)	LWT (F)	Extract Heat (MBtuH)	Pressure Drop (psig)	Pressure Drop (ft)	EWT (F)	Heating Capacity (MBtuH)	Power (kW)	LWT (F)	COP	Pressure Drop (psig)	Pressure Drop (ft)
10	6.2	171.6	9.77	22.6	50	233.0	15.3	54.8	4.5	10.57	24.4
	6.4	166.3	9.94	23.0	60	231.1	17.1	64.7	4.0	10.10	23.3
	6.5	160.6	10.07	23.3	70	230.5	19.1	74.6	3.5	9.72	22.4
	6.7	154.4	10.15	23.4	80	231.2	21.4	84.5	3.2	9.43	21.8
	6.8	147.8	10.18	23.5	90	233.4	24.1	94.5	2.8	9.24	21.3
	7.0	140.7	10.17	23.5	100	236.9	27.0	104.5	2.6	9.14	21.1
7.2	133.2	10.11	23.3	110	241.9	30.3	114.6	2.3	9.14	21.1	
20	15.0	237.7	8.81	20.3	50	303.0	16.2	56.2	5.5	11.07	25.6
	15.2	227.8	9.00	20.8	60	296.6	17.8	66.0	4.9	10.59	24.4
	15.4	218.2	9.15	21.1	70	292.3	19.8	75.8	4.3	10.20	23.6
	15.6	208.2	9.25	21.4	80	289.4	22.1	85.7	3.8	9.91	22.9
	15.9	198.2	9.29	21.5	90	288.3	24.7	95.6	3.4	9.71	22.4
	16.1	187.0	9.30	21.5	100	287.8	27.6	105.5	3.1	9.61	22.2
16.4	175.5	9.25	21.4	110	288.9	30.8	115.5	2.7	9.60	22.2	
16.6	163.9	9.16	21.1	120	291.9	34.3	125.5	2.5	9.69	22.4	
30	23.7	305.6	8.03	18.5	50	373.8	17.0	57.7	6.4	11.51	26.6
	24.0	291.4	8.24	19.0	60	363.3	18.6	67.4	5.7	11.02	25.5
	24.3	277.8	8.40	19.4	70	355.0	20.5	77.1	5.1	10.63	24.6
	24.6	264.0	8.52	19.7	80	348.5	22.8	86.9	4.5	10.34	23.9
	24.9	250.2	8.58	19.8	90	343.7	25.3	96.7	4.0	10.13	23.4
	25.2	235.2	8.60	19.9	100	339.5	28.2	106.6	3.5	10.02	23.2
	25.5	219.9	8.57	19.8	110	337.0	31.3	116.4	3.2	10.01	23.1
	25.9	204.5	8.49	19.6	120	336.3	34.8	126.4	2.8	10.10	23.3
26.2	187.8	8.37	19.3	130	336.0	38.6	136.3	2.6	10.28	23.7	
40	32.1	372.0	7.45	17.2	50	442.0	17.8	59.1	7.3	11.89	27.5
	32.5	354.9	7.68	17.7	60	428.6	19.4	68.7	6.5	11.40	26.3
	32.8	337.6	7.85	18.1	70	416.9	21.3	78.4	5.7	11.00	25.4
	33.2	319.9	7.98	18.4	80	406.5	23.4	88.1	5.1	10.70	24.7
	33.6	302.0	8.07	18.6	90	397.8	25.9	97.8	4.5	10.49	24.2
	34.0	283.3	8.10	18.7	100	390.1	28.7	107.6	4.0	10.38	24.0
	34.4	264.4	8.09	18.7	110	384.0	31.9	117.4	3.5	10.36	23.9
	34.7	245.2	8.02	18.5	120	379.6	35.3	127.2	3.2	10.44	24.1
	35.2	225.0	7.92	18.3	130	375.9	39.0	137.0	2.8	10.62	24.5
35.4	213.9	7.84	18.1	135	374.5	41.2	142.4	2.7	10.75	24.8	
50	41.3	422.5	7.29	16.8	60	497.1	20.2	70.1	7.2	11.74	27.1
	41.7	401.5	7.48	17.3	70	481.7	22.0	79.7	6.4	11.33	26.2
	42.2	380.0	7.63	17.6	80	467.6	24.1	89.3	5.7	11.03	25.5
	42.6	358.4	7.72	17.8	90	455.4	26.6	99.0	5.0	10.81	25.0
	43.1	335.7	7.78	18.0	100	443.7	29.3	108.6	4.4	10.69	24.7
	43.5	312.6	7.78	18.0	110	433.7	32.4	118.3	3.9	10.67	24.6
	44.0	289.6	7.73	17.9	120	425.5	35.8	128.1	3.5	10.75	24.8
44.5	265.3	7.64	17.6	130	417.9	39.4	137.8	3.1	10.92	25.2	
44.7	252.5	7.57	17.5	135	414.9	41.6	143.2	2.9	11.04	25.5	
60	50.6	467.1	7.30	16.9	70	547.1	22.7	81.0	7.1	11.61	26.8
	51.1	441.8	7.46	17.2	80	529.4	24.8	90.6	6.3	11.30	26.1
	51.6	416.5	7.57	17.5	90	513.4	27.2	100.1	5.5	11.08	25.6
	52.2	389.9	7.64	17.7	100	498.1	29.9	109.7	4.9	10.96	25.3
	52.7	363.1	7.66	17.7	110	484.5	32.9	119.3	4.3	10.93	25.2
	53.2	336.2	7.63	17.6	120	472.6	36.3	129.0	3.8	11.00	25.4
	53.8	307.9	7.56	17.5	130	461.1	39.9	138.7	3.4	11.16	25.8
54.1	292.9	7.50	17.3	135	456.0	42.0	144.0	3.2	11.29	26.1	
70	60.1	505.8	7.47	17.3	80	592.2	25.5	91.8	6.8	11.52	26.6
	60.7	476.5	7.60	17.6	90	572.4	27.8	101.3	6.0	11.30	26.1
	61.3	446.1	7.69	17.8	100	553.4	30.5	110.8	5.3	11.17	25.8
	61.9	415.5	7.72	17.8	110	536.1	33.4	120.3	4.7	11.14	25.7
	62.5	384.8	7.71	17.8	120	520.4	36.7	129.9	4.2	11.20	25.9
	63.1	352.8	7.65	17.7	130	505.4	40.3	139.5	3.7	11.36	26.2
63.5	335.3	7.60	17.6	135	497.9	42.4	144.7	3.4	11.48	26.5	



- For operations outside this table contact the manufacturer
- Interpolation is permissible, extrapolation is not
- Antifreeze may be required at some operating temperatures to prevent freezing
- The fluid entering the unit must pass through a straining/ filtering device
- As a result of further research and development specifications are subject to improvements without notice
- Data normalized to water, correction factors for antifreeze required where applicable
- 3rd party tested
- for 50Hz operation deduct 16.7% from the capacity



**KS450 Performance Data Cooling**

SOURCE Condenser						LOAD Evaporator						
EWT (F)	LWT (F)	Reject Heat (MBtuH)	Power (kW)	Pressure Drop (psig)	Pressure Drop (ft)	EWT (F)	Cooling Capacity (MBtuH)	Cooling Capacity (Tons)	LWT (F)	EER	Pressure Drop (psig)	Pressure Drop (ft)
50	54.8	233.0	15.3	10.57	24.4	10	171.6	13.4	6.2	11.2	9.77	22.6
	56.2	303.0	16.2	11.07	25.6	20	237.7	18.5	15.0	14.7	8.81	20.3
	57.7	373.8	17.0	11.51	26.6	30	305.6	23.8	23.7	18.0	8.03	18.5
	59.1	442.0	17.8	11.89	27.5	40	372.0	29.0	32.1	20.9	7.45	17.2
60	64.7	231.1	17.1	10.10	23.3	10	166.3	13.0	6.4	9.7	9.94	23.0
	66.0	296.6	17.8	10.59	24.4	20	227.8	17.7	15.2	12.8	9.00	20.8
	67.4	363.3	18.6	11.02	25.5	30	291.4	22.7	24.0	15.6	8.24	19.0
	68.7	428.6	19.4	11.40	26.3	40	354.9	27.6	32.5	18.3	7.68	17.7
70.1	497.1	20.2	11.74	27.1	50	422.5	32.9	41.3	21.0	7.29	16.8	
70	74.6	230.5	19.1	9.72	22.4	10	160.6	12.5	6.5	8.4	10.07	23.3
	75.8	292.3	19.8	10.20	23.6	20	218.2	17.0	15.4	11.0	9.15	21.1
	77.1	355.0	20.5	10.63	24.6	30	277.8	21.6	24.3	13.5	8.40	19.4
	78.4	416.9	21.3	11.00	25.4	40	337.6	26.3	32.8	15.9	7.85	18.1
	79.7	481.7	22.0	11.33	26.2	50	401.5	31.3	41.7	18.3	7.48	17.3
81.0	547.1	22.7	11.61	26.8	60	467.1	36.4	50.6	20.6	7.30	16.9	
80	84.5	231.2	21.4	9.43	21.8	10	154.4	12.0	6.7	7.2	10.15	23.4
	85.7	289.4	22.1	9.91	22.9	20	208.2	16.2	15.6	9.4	9.25	21.4
	86.9	348.5	22.8	10.34	23.9	30	264.0	20.6	24.6	11.6	8.52	19.7
	88.1	406.5	23.4	10.70	24.7	40	319.9	24.9	33.2	13.6	7.98	18.4
	89.3	467.6	24.1	11.03	25.5	50	380.0	29.6	42.2	15.8	7.63	17.6
	90.6	529.4	24.8	11.30	26.1	60	441.8	34.4	51.1	17.8	7.46	17.2
91.8	592.2	25.5	11.52	26.6	70	505.8	39.4	60.1	19.8	7.47	17.3	
90	94.5	233.4	24.1	9.24	21.3	10	147.8	11.5	6.8	6.1	10.18	23.5
	95.6	288.3	24.7	9.71	22.4	20	198.2	15.4	15.9	8.0	9.29	21.5
	96.7	343.7	25.3	10.13	23.4	30	250.2	19.5	24.9	9.9	8.58	19.8
	97.8	397.8	25.9	10.49	24.2	40	302.0	23.5	33.6	11.6	8.07	18.6
	99.0	455.4	26.6	10.81	25.0	50	358.4	27.9	42.6	13.5	7.72	17.8
	100.1	513.4	27.2	11.08	25.6	60	416.5	32.4	51.6	15.3	7.57	17.5
101.3	572.4	27.8	11.30	26.1	70	476.5	37.1	60.7	17.1	7.60	17.6	
100	104.5	236.9	27.0	9.14	21.1	10	140.7	11.0	7.0	5.2	10.17	23.5
	105.5	287.8	27.6	9.61	22.2	20	187.0	14.6	16.1	6.8	9.30	21.5
	106.6	339.5	28.2	10.02	23.2	30	235.2	18.3	25.2	8.3	8.60	19.9
	107.6	390.1	28.7	10.38	24.0	40	283.3	22.1	34.0	9.9	8.10	18.7
	108.6	443.7	29.3	10.69	24.7	50	335.7	26.1	43.1	11.5	7.78	18.0
	109.7	498.1	29.9	10.96	25.3	60	389.9	30.4	52.2	13.0	7.64	17.7
110.8	553.4	30.5	11.17	25.8	70	446.1	34.7	61.3	14.6	7.69	17.8	
110	114.6	241.9	30.3	9.14	21.1	10	133.2	10.4	7.2	4.4	10.11	23.3
	115.5	288.9	30.8	9.60	22.2	20	175.5	13.7	16.4	5.7	9.25	21.4
	116.4	337.0	31.3	10.01	23.1	30	219.9	17.1	25.5	7.0	8.57	19.8
	117.4	384.0	31.9	10.36	23.9	40	264.4	20.6	34.4	8.3	8.09	18.7
	118.3	433.7	32.4	10.67	24.6	50	312.6	24.3	43.5	9.7	7.78	18.0
	119.3	484.5	32.9	10.93	25.2	60	363.1	28.3	52.7	11.0	7.66	17.7
120.3	536.1	33.4	11.14	25.7	70	415.5	32.4	61.9	12.4	7.72	17.8	
120	125.5	291.9	34.3	9.69	22.4	20	163.9	12.8	16.6	4.8	9.16	21.1
	126.4	336.3	34.8	10.10	23.3	30	204.5	15.9	25.9	5.9	8.49	19.6
	127.2	379.6	35.3	10.44	24.1	40	245.2	19.1	34.7	6.9	8.02	18.5
	128.1	425.5	35.8	10.75	24.8	50	289.6	22.6	44.0	8.1	7.73	17.9
	129.0	472.6	36.3	11.00	25.4	60	336.2	26.2	53.2	9.3	7.63	17.6
	129.9	520.4	36.7	11.20	25.9	70	384.8	30.0	62.5	10.5	7.71	17.8
130	136.3	336.0	38.6	10.28	23.7	30	187.8	14.6	26.2	4.9	8.37	19.3
	137.0	375.9	39.0	10.62	24.5	40	225.0	17.5	35.2	5.8	7.92	18.3
	137.8	417.9	39.4	10.92	25.2	50	265.3	20.7	44.5	6.7	7.64	17.6
	138.7	461.1	39.9	11.16	25.8	60	307.9	24.0	53.8	7.7	7.56	17.5
	139.5	505.4	40.3	11.36	26.2	70	352.8	27.5	63.1	8.8	7.65	17.7
135	142.4	374.5	41.2	10.75	24.8	40	213.9	16.7	35.4	5.2	7.84	18.1
	143.2	414.9	41.6	11.04	25.5	50	252.5	19.7	44.7	6.1	7.57	17.5
	144.0	456.0	42.0	11.29	26.1	60	292.9	22.8	54.1	7.0	7.50	17.3
	144.7	497.9	42.4	11.48	26.5	70	335.3	26.1	63.5	7.9	7.60	17.6



- For operations outside this table contact the manufacturer

- Interpolation is permissible, extrapolation is not

- Antifreeze may be required at some operating temperatures to prevent freezing

- The fluid entering the unit must pass through a straining/ filtering device

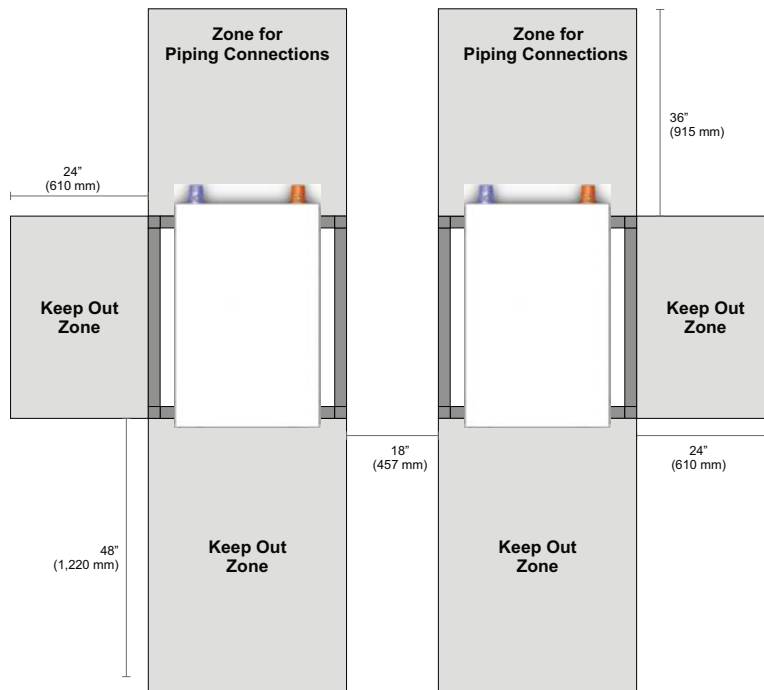
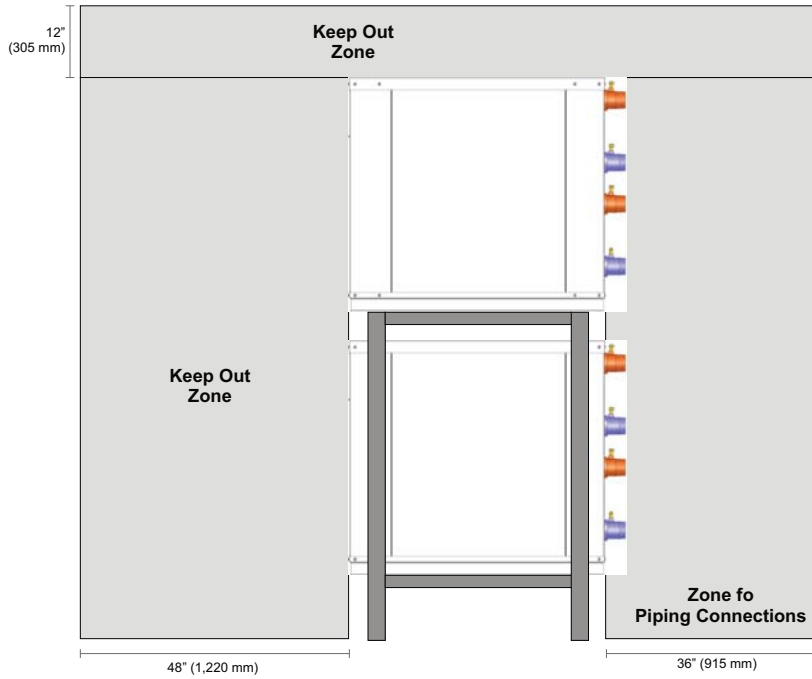
- As a result of further research and development specifications are subject to improvements without notice

- Data normalized to water, correction factors for antifreeze required where applicable

- 3rd party tested

- for 50Hz operation deduct 16.7% from the capacity

# Installation Clearance Area



Top view

**Install Clearance  
KS 096 – KS 450**

**Written  
Specifications**

Date: 21/12/2012

Project:



Suite 114 – 11 Morris Drive  
Dartmouth, NS B3B 1M2  
P: 902-481-2398 F: 902-481-2426