Spec-Tech-Sales

Integrated Boiler Room Solutions
Commercial Technical Sales and Service
For the Rocky Mountain Region
14652 West Vassar Drive
Lakewood, CO 80228
Colorado Phone 720-259-0718 Fax 720-204-2274
Wyoming Phone 307-222-7559 Fax 307-200-4068

Website: www.spec-tech-sales.com

October 27, 2015

Operations & Maintenance Manuals

SHX-1 thru SHX-6 Brazed Plate Heat Exchangers Specification Section # 23 2113 – Hydronic Specialties

Project Name and Owner:
Kelly Walsh High School
3500 East 12'th Street
Natrona County School District # 1
Casper, Wyoming 82609

Architect:
RB+B Architects
Fort Collins, Colorado

Mechanical Engineer:
Engineering Design Associates
Casper, Wyoming

Mechanical Contractor:
KK Mechanical
Roy, Utah

Sheet Metal Contractor:
North Star HVAC
West Haven, Utah

Controls Contractor:
Johnson Controls
Casper, Wyoming

Wholesale Distributor:
Ferguson Enterprises
Mills, Wyoming

AIC – Advanced Industrial Components

Brazed Plate Heat Exchangers

BASED UPON 100% FINAL CONSTRUCTION DRAWINGS & SPECIFICATIONS

100% Construction Drawings & Documents
Issue Date May 12, 2014

Schedule Tag: SHX-1 thru SHX-6 Brazed Plate Heat Exchangers
Specification Section # 23 2113 Hydronic Specialties

Also Reference:

Specification Section # 23 5225 Gas Fired Packaged Condensing Boilers – Separate Submittal Package
Specification Section # 22 3000 Plumbing Equipment – Separate Submittal Package
Specification Section # 23 5100 Vent Stacks – Separate Submittal Package
Specification Section # 23 2114 Hydronic Specialties – Separate Submittal Package
-And-
Specification Section # 01 1600 Product Requirements
Specification Section # 23 0593 Testing Adjusting & Balancing
Specification Section # 23 0800 Commissioning of HVAC System
Specification Section # 23 0900 Building Automation System
Specification Section # 23 2500 HVAC Water Treatment
Specification Section # 23 2113 Hydronic Piping
Specification Section # 23 2114 Hydronic Specialties – Other Material
Specification Section # 23 2123 Hydronic Pumps
Scope Primarily Provided By Others - Listed For Coordination Purposes

AIC - Advanced Industrial Components

Brazed Plate Heat Exchangers – Scope of Supply

Tag: **SHX-1** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LC110-40HBR project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **29.39-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **3.50'-TDH** pressure drop and cold side / snowmelt side conditions of **36.8-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **6.2'-TDH** pressure drop with approximate total heating load / heat exchanged of **415,431-BTU's** per hour.

NOTE: The **hot side** pressure drop of **3.50'-TDH** head loss is less than the scheduled **6.08'-TDH** head loss, and the **cold side** pressure drop of **6.20'-TDH** head loss is less than the scheduled **9.64'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LC110-40HBR as proposed.

Tag: **SHX-2** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LB31-100XJ project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **14.38-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **1.30'-TDH** pressure drop and cold side / snowmelt side conditions of **18-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **2.0'-TDH** pressure drop with approximate total heating load / heat exchanged of **203,199-BTU's** per hour.

NOTE: The **hot side** pressure drop of **1.30'-TDH** head loss is slightly more than the scheduled **1.23'-TDH** head loss, and the **cold side** pressure drop of **2.00'-TDH** head loss is slightly more than the scheduled **1.99'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LB31-100XJ as proposed.

Tag: **SHX-3** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LB31-60XJ project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **9.98-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **1.10'-TDH** pressure drop and cold side / snowmelt side conditions of **12.5-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **1.70'-TDH** pressure drop with approximate total heating load / heat exchanged of **141,111-BTU's** per hour.

NOTE: The **hot side** pressure drop of **1.10'-TDH** head loss is slightly more than the scheduled **1.08'-TDH** head loss, and the **cold side** pressure drop of **1.70'-TDH** head loss is slightly less than the scheduled **1.71'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LB31-60XJ as proposed.

Tag: **SHX-4** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LB31-60XJ project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **9.19-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **1.0'-TDH** pressure drop and cold side / snowmelt side conditions of **11.50-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **1.50'-TDH** pressure drop with approximate total heating load / heat exchanged of **129,822-BTU's** per hour.

NOTE: The **hot side** pressure drop of **1.0'-TDH** head loss is slightly more than the scheduled **0.92'-TDH** head loss, and the **cold side** pressure drop of **1.50'-TDH** head loss is slightly more than the scheduled **1.46'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LB31-60XJ as proposed.

Tag: **SHX-5** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LB31-20XJ project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **1.92-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **0.40'-TDH** pressure drop and cold side / snowmelt side conditions of **2.40-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **0.60'-TDH** pressure drop with approximate total heating load / heat exchanged of **27,093-BTU's** per hour.

NOTE: The **hot side** pressure drop of **0.40'-TDH** head loss is consistent the scheduled **0.40'-TDH** head loss, and the **cold side** pressure drop of **0.60'-TDH** head loss is slightly more than the scheduled **0.58'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LB31-20XJ as proposed.

Tag: **SHX-6** Brazed Plate Heat Exchanger Assembly – Re-Submittal for Approval

Project specific (1) each **AIC – Advanced Industrial Components** model # LB31-30XJ project / application specific brazed plate heat exchanger assembly sized and selected for hot side conditions of **3.19-GPM** of **35%** multi-metal aluminum safe glycol from **140-degrees F.** EWT to **110-degrees F.** LWT with **0.60'-TDH** pressure drop and cold side / snowmelt side conditions of **4.0-GPM** of **50% propylene glycol** from **90-degrees F.** EWT to **115-degrees F.** LWT with **0.90'-TDH** pressure drop with approximate total heating load / heat exchanged of **45,155-BTU's** per hour.

NOTE: The **hot side** pressure drop of **0.60'-TDH** head loss is slightly more than the scheduled **0.59'-TDH** head loss, and the **cold side** pressure drop of **0.90'-TDH** head loss is slightly more than the scheduled **0.85'-TDH** head loss, and as such we are hopeful that this re-submittal as issued will satisfy the performance and design intent considerations without significant compromise. The heat transfer surface area square feet, and the heat transfer capacity meets or exceeds the projects scheduled requirements, and as such we are respectfully requesting formal approval of the resubmitted (1) each **AIC – Advanced Industrial Components** model # LB31-30XJ as proposed.

BASE PACKAGE SCOPE – FIELD PIPING & INTERFACE CONNECTIONS

Lot package scope summary overview complete as detailed above for the **SHX-1** thru **SHX-6** brazed plate heat exchangers (6) total **AIC – Advanced Industrial Components** project specific selections as listed complete with factory authorized initial startup / programming and combustion test to be done by Spec-Tech-Sales for the ***1'st trip*** during the ***initial temporary heating*** requirements and the ***2'nd trip*** for the final system startup upon construction completion and a ***3'rd trip*** for follow up assessment and fine tuning ***after 6-months*** of operation, along ***with extended (for temporary heating requirements) and enhanced limited warranty offerings*** including site visit assessment and any and all applicable limited boiler scope warranty related labor assessment and work to be done by Spec-Tech-Sales *warranty terms and conditions to apply* complete with freight included to project destination.

AIC – Advanced Industrial Components: Global manufacturing leader of shell and tube heat exchanger offerings, plate and frame heat exchangers, brazed plate heat exchangers, vertical helical corrugated coil heat exchangers and the like. They offer engineered system expertise and manufacturing for a broad array of heat recovery and heat transfer applications including but not limited to: Steam or liquid heating systems, Chilled water systems, Pool – hot tub – spa, Groundwater systems, Food service - beverage - dairy - brewery - pasteurization, Radiant - snowmelt systems, Marine service applications with saltwater or similar, Domestic water heat exchange, Condensing stack economizer - heat recovery of boiler exhaust, Industrial - process - manufacturing applications, Any fluid heat transfer IE oils - glycol - refrigeration - oil cooling, Mining applications, Waste water heat recovery, Condensate heat transfer - heat recovery, Boiler sample coolers, Transmission and engine cooler, Pharmaceutical - Bio-tech, High purity - semi-conductor, Clean steam

- **Heat exchangers / heat transfer** engineered solutions for liquid to liquid or steam to liquid applications
- Project specific engineered solutions for varying applications and system temperatures / pressures, heat transfer media, and thermal efficiency
- Certified to strict **ISO-9001** manufacturing and process standards with **ASME code section VIII, division 1** bearing the **U or UM** stamp accordingly
- **A-Line** innovative high performance plate and frame heat exchangers with stainless steel, titanium or hastelloy plates
- **JAD series** compact stainless steel vertical helically corrugated tube design heat exchangers offering superior thermal efficiency
- **B-Line** high velocity low pressure drop with efficient corrugated tube design stainless steel heat exchangers
- **PS / PW-Line** removable u-tube bundle shell and tube heat exchangers with 2 or 4-pass design
- **L-Line** compact brazed plate heat exchangers high performance and efficiency corrugated surface stainless steel plates
- **T-Line** plastic shell and tube heat exchangers ideal for pool and spa applications
- **TEE-W** line pure titanium shell and helical coil heat exchangers for optimum corrosion resistance, heat transfer coefficient & flow turbulence
- **LENS line** heat exchanger line offering multiple innovative adaptive and modular stainless steel designs in various configurations and capacities
- **E-Line** boiler stack flue gas economizers and heat recovery units for enhanced efficiency gains through capturing boiler exhaust energy - BTU's
- **S-Line** high grade stainless steel sanitary heat exchangers for food grade, pharmaceutical, clean steam and bio-tech applications – **FDA** compliance

1. Our proposal includes the items and bill of material as listed, and is offered subject to final mechanical engineer owner approval in its entirety complete with exceptions and clarifications as noted. Pricing and / or scope adjustments to follow for any additional material required over and above our base package scope as offered and / or for change orders or directives as given and / or for reduction in scope if / as required.
2. Our proposal includes conservative freight allowance (standard shipping freight is included in this proposal) included from factory destination to jobsite destination with some initial projections factored in for realistic shipping and scheduling guidelines – IE multiple shipments are accounted for in this proposal and scope.
3. NOTE: Upon receipt, please forward stamped approved submittal package and when applicable any coordination requirements for the formal release to production, fabrication and subsequent shipping as needed. Project specific installation / operation and maintenance manuals and any point to point wiring interface clarification assistance to follow upon receipt of approved submittal package. Approximate material shipping material lead time frames upon release to production and fabrication as follows:
4. Approximate shipping lead time frame after receipt of formal submittal approval and formal release to production and fabrication:
    - **AIC – Advanced Industrial Components** heat exchangers = approximately **2-weeks**

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-1
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-01
PREPARED BY: Gaurav Bajaj
REF: 0290-140908150102-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	415431.07 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	14806.31 lb/h	18991.42 lb/h
Volume Flow	29.39 USGal/min	36.80 USGal/min

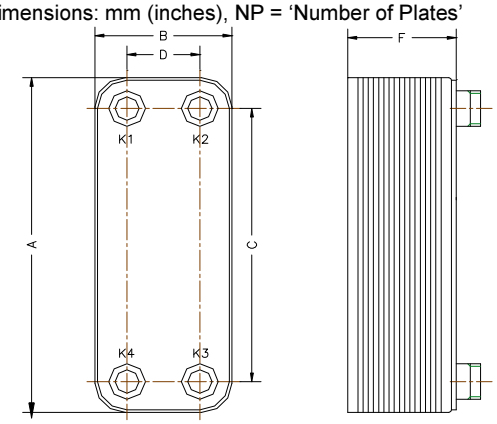
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LC110 – 40HBR	
# of Units Parallel	1.00	
Heat Transfer Area	46.4 ft2	
Fouling Factor	0.0005 ft2hf/BTU	
OHTC Clean	488.8 BTU/ft2hf	
OHTC Fouling	399.5 BTU/ft2hf	
Oversize	22.4 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	3.5 ft	6.2 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
462 (18.2)	254 (10.0)	378.5(14.9)	170.2(6.7)	13.4 + 2.8NP(0.53+ 0.11NP)	2.5"	2.5"	2.5"	2.5"

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-2
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-02
PREPARED BY: Gaurav Bajaj
REF: 0290-140908150452-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	203199.95 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	7242.22 lb/h	9289.28 lb/h
Volume Flow	14.38 USGal/min	18.00 USGal/min

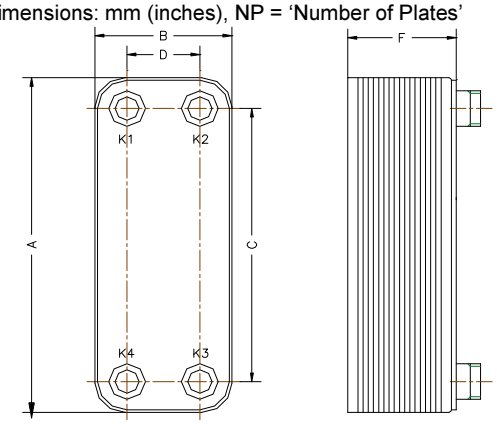
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LB31 – 100XJ	
# of Units Parallel	1.00	
Heat Transfer Area	34.0 ft2	
Fouling Factor	0.0004 ft2hf/BTU	
OHTC Clean	320.6 BTU/ft2hf	
OHTC Fouling	286.2 BTU/ft2hf	
Oversize	12.0 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	1.3 ft	2.0 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
306 (12.0)	126 (5.0)	248.9(9.8)	69.9(2.75)	12.4 + 2.4NP(0.49+ 0.09NP)	1"	1"	1"	1"

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-3
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-03
PREPARED BY: Gaurav Bajaj
REF: 0290-140908150601-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	141111.10 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	5029.32 lb/h	6450.89 lb/h
Volume Flow	9.98 USGal/min	12.50 USGal/min

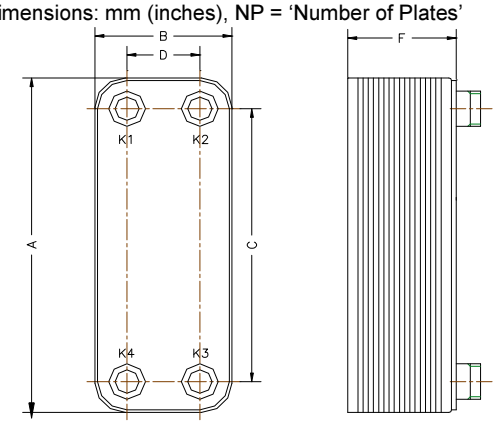
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LB31 – 60XJ	
# of Units Parallel	1.00	
Heat Transfer Area	20.4 ft2	
Fouling Factor	0.0002 ft2hf/BTU	
OHTC Clean	352.2 BTU/ft2hf	
OHTC Fouling	331.2 BTU/ft2hf	
Oversize	6.3 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	1.1 ft	1.7 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
306 (12.0)	126 (5.0)	248.9(9.8)	69.9(2.75)	12.4 + 2.4NP(0.49+ 0.09NP)	1"	1"	1"	1"

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-4
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-04
PREPARED BY: Gaurav Bajaj
REF: 0290-140908150706-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	129822.24 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	4626.97 lb/h	5934.82 lb/h
Volume Flow	9.19 USGal/min	11.50 USGal/min

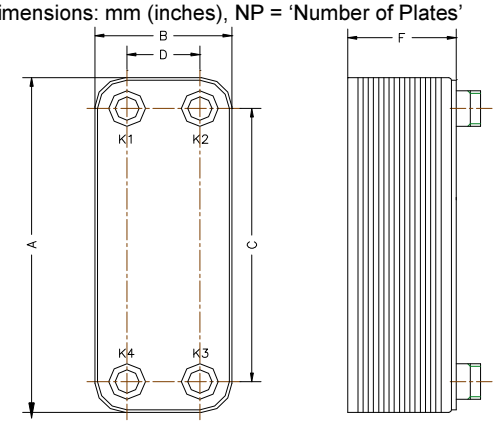
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LB31 – 60XJ	
# of Units Parallel	1.00	
Heat Transfer Area	20.4 ft2	
Fouling Factor	0.0003 ft2hf/BTU	
OHTC Clean	333.9 BTU/ft2hf	
OHTC Fouling	304.7 BTU/ft2hf	
Oversize	9.6 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	1.0 ft	1.5 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
306 (12.0)	126 (5.0)	248.9(9.8)	69.9(2.75)	12.4 + 2.4NP(0.49+ 0.09NP)	1"	1"	1"	1"

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-5
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-05
PREPARED BY: Gaurav Bajaj
REF: 0290-140908150855-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	27093.31 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	965.63 lb/h	1238.57 lb/h
Volume Flow	1.92 USGal/min	2.40 USGal/min

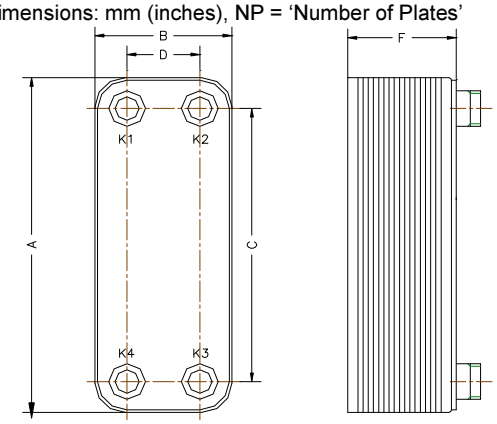
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LB31 – 20XJ	
# of Units Parallel	1.00	
Heat Transfer Area	6.8 ft2	
Fouling Factor	0.0012 ft2hf/BTU	
OHTC Clean	246.1 BTU/ft2hf	
OHTC Fouling	190.8 BTU/ft2hf	
Oversize	29.0 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	0.4 ft	0.6 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
306 (12.0)	126 (5.0)	248.9(9.8)	69.9(2.75)	12.4 + 2.4NP(0.49+ 0.09NP)	1"	1"	1"	1"

2899 Portland Drive
Oakville, ON
L6H 5S4 Canada
T: 905 829 4666, F: 905 829 4646

DATE: 08/09/2014
PROJECT: SHX-6
CONTACT: Rich Apple
COMPANY: Spec-Tech-Sales
CALC. NO.: K140908-23-06
PREPARED BY: Gaurav Bajaj
REF: 0290-140908151026-140502

HEAT EXCHANGERS CALCULATION SHEET

PROJECT DATA SHEET

Heat Load	45155.45 BTU/h	
LMTD	22.4 deg. F	
Min. Oversizing	0 %	
	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Inlet Temperature	140.00 deg. F	90.00 deg. F
Outlet Temperature	110.00 deg. F	115.00 deg. F
Mass Flow	1609.38 lb/h	2064.28 lb/h
Volume Flow	3.19 USGal/min	4.00 USGal/min

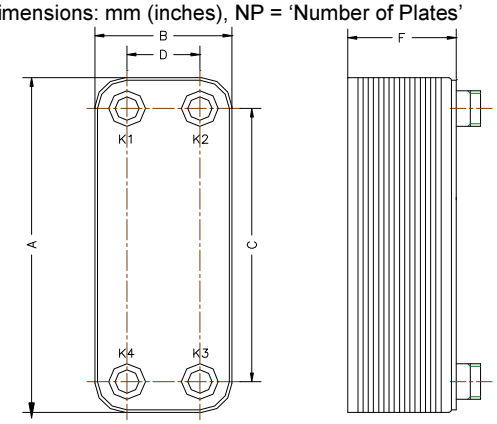
HEAT EXCHANGER SELECTION

Heat Exchanger Type	LB31 – 30XJ	
# of Units Parallel	1.00	
Heat Transfer Area	10.2 ft2	
Fouling Factor	0.0009 ft2hf/BTU	
OHTC Clean	263.7 BTU/ft2hf	
OHTC Fouling	212.0 BTU/ft2hf	
Oversize	24.4 %	
	Hot Side	**Cold Side**
Calculated Pressure Drop	0.6 ft	0.9 ft
Heat Transfer NTU	-	-

PHYSICAL PROPERTIES

	Hot Side	**Cold Side**
Fluid	glycol_(propylene)_35%	glycol_(propylene)_50%
Pressure	100.0 psig	100.0 psig
Reference Temperature	125.0 deg. F	102.5 deg. F
Density	63.115 lb/ft3	64.03 lb/ft3
Heat Capacity	0.935 BTU/lbF	0.875 BTU/lbF
Thermal Conductivity	0.261 BTU/fthF	0.218 BTU/fthF
Dynamic Viscosity	1.276 cP	2.879 cP

Dimensions: mm (inches), NP = 'Number of Plates'



A	B	C	D	F	K1	K2	K3	K4
306 (12.0)	126 (5.0)	248.9(9.8)	69.9(2.75)	12.4 + 2.4NP(0.49+ 0.09NP)	1"	1"	1"	1"

AIC

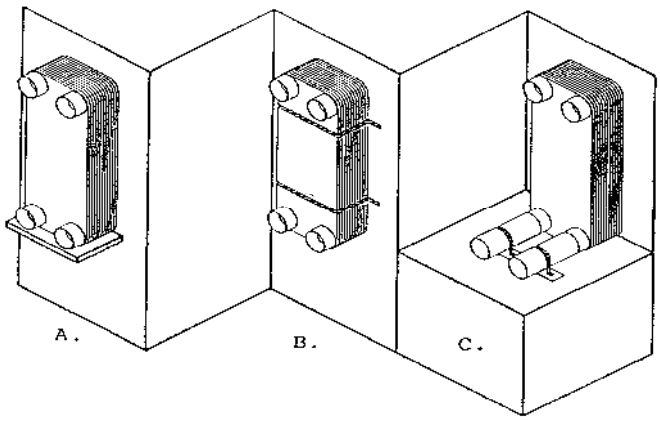
Brazed Plate Heat Exchanger

Operating and Instruction Manual

1.0 Installation

1.1 Mounting/support unit:

a) On a shelf
b) By brackets or straps
c) By using the pipework



Avoid drilling through any part of the exchanger

AIC heat exchangers should be mounted in such a way that there is sufficient room around the heat exchanger to perform maintenance work. Never expose the unit to pulsations or excessive cyclic pressure or temperature changes. It is also important that no vibrations are transferred to the heat exchanger. If there is a risk of this, install vibration absorbers. For larger connection diameters, use an expanding device in the pipeline, e.g. a rubber mounting strip as a buffer between the BHE and the mounting clamp. It is recommended that AIC brazed heat exchangers be mounted in the vertical position (Fig.1).

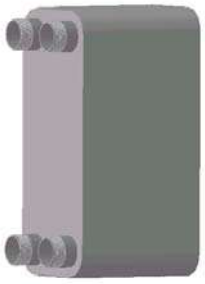


Fig.1 Vertical mounting position - recommended

Where space and piping require another position, the following guidelines should be followed:

For liquid-to-liquid, single phase applications, the heat exchanger can be mounted in any position that does not create the possibility of trapping air or other gases in the heat exchanger (Fig.2). Therefore, never mount the heat exchanger with the connections pointing down (Fig.3). If the heat exchanger must be mounted with the connections on the side, orient the heat exchanger so that the nozzles connected to the fluid that has the possibility of gas or air entrained is at the top.

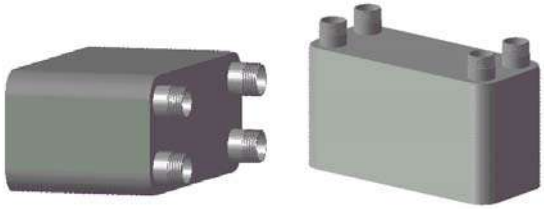


Fig.2 Optional positions for single phase only

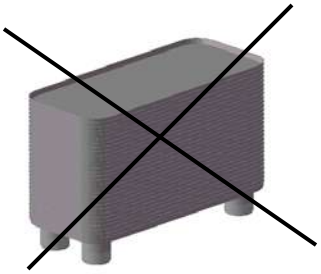


Fig.3 DO NOT mount with connections down

For all two-phase applications the heat exchanger should always be mounted vertically. If this is not possible, contact AIC for recommendations on mounting. The exchangers may have some sharp edges so exercise caution when handling.

1.2 Piping Connections:

In most applications the highest efficiency will be realized by connecting the heat exchanger for countercurrent flow (Fig.4). Certain special applications may require co-current (parallel) flow (Fig.5).

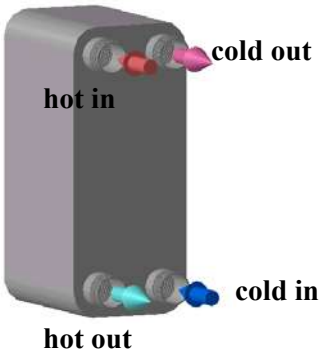


Fig.4 Countercurrent Flow

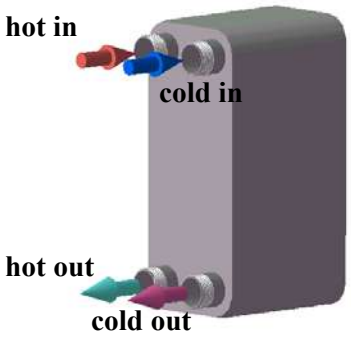


Fig.5 Co-current (parallel) flow

In systems where the water quality is in question, the installation of a strainer is required to prevent large particles from becoming lodged in the heat exchanger. A 16 to 20 mesh strainer is recommended. Blockage in the heat exchanger will lead to fouling or freezing of the heat exchanger. The strainer must be located at the inlet to the heat exchanger. Strainers located at the cooling tower or pump, while worthwhile for system operation, will not adequately protect the heat exchanger.

On new or renovation systems, flushing the liquid piping to remove construction debris is recommended before connecting the piping to the heat exchanger.

- **Avoid** over-tightening unions onto the threaded connections. **Excessive force** will shear the connection braze. The threads are parallel. Seal unions by use of an O-ring or a round gasket located at the end of the connection, or seal the threads by use of tape.

- The use of **flexible pipework** is strongly recommended. Vibrations from the pipework, and control valves must not be transferred to the heat exchanger.

- Ensure that there are adequate expansion/safety valves installed into the adjacent pipework.

- If the pipework is to be soldered into the nozzles on the exchanger, then:

- Fill the other circuit with water (circuit must be open to the atmosphere).
- Wrap a wet towel around the base of the connection to be soldered.
- Use solder containing no less than **45%** silver.

On no account weld connections onto or near the exchanger.

2.0 Operation

2.1 Start-Up Procedure:

1. Close all insulation valves.
2. At first fill and vent coldest circuit.
3. Start circulation of cold circuit, opening insulation valves gradually.
4. Repeat with hot circuit.
5. Automatic control regulation can now be started.
6. Only open in pressure-free conditions.

Steam
Drain the steam circuit first prior to opening steam valve. This precaution helps reduce the probability of water hammer.

Water hammer and thermal shock will cause damage to the exchanger.

2.2 Shut Down Procedure:

1. Close down hot circuit by **slow** adjustment of the control valve. Full flow on the cold circuit should be maintained.
2. When control valve is fully closed, switch off the pump.
3. **Slowly** close down cold circuit, then switch off the pump.
4. Close all insulation valves.
5. When cool, drain unit completely.

2.3 Cleaning:

AIC brazed plate heat exchangers operate with high turbulence flow, even at low flow rates. This high turbulence keeps small particles in suspension minimizing fouling and scaling. However, in some applications the fouling tendency can be very high, e.g. when using extremely hard water at high temperatures. In such cases it is always possible to clean the exchanger by circulating a cleaning liquid . Use a tank with weak acid, 5% phosphoric acid or, if the exchanger is frequently cleaned, 5% oxalic acid. Pump the cleaning liquid through the exchanger. For optimum cleaning, the cleaning solution flow rate should be a minimum of 1.5 times the normal flow rate, preferably in a back-flush mode. After use, do not forget to rinse the heat exchanger carefully with clean water. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate (NaHCO3) before the last rinse ensures that all acid is neutralized. Clean at regular intervals.

- Only chemical cleaning is possible.
- Only use chemicals which do not attack copper and stainless steel. Consult a cleaning specialist in case of doubt.

3.0 Refrigerant

AIC brazed plate heat exchangers are used extensively as refrigerant condensers and evaporators. For condenser applications, (Fig. 6), the superheated discharge gas enters the heat exchanger at the top left and subcooled liquid refrigerant condensate leaves from the bottom left connection. The cooling water enters at the bottom right and leaves at the top right. This true countercurrent flow allows close approaches resulting in increased efficiency and lower water flow rates.

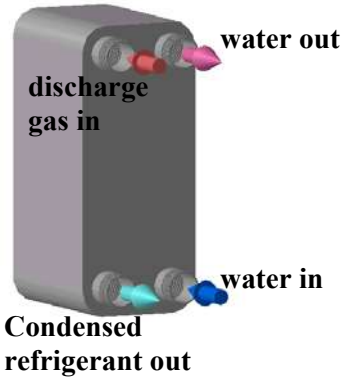


Fig.6 Water-cooled condenser

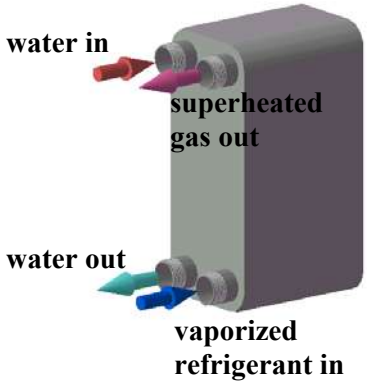


Fig.7 Evaporator-Liquid chiller

Refrigerant Applications and Expansion Valves

For evaporator applications (Fig.7), the expansion valve should be placed close to the inlet connection, whereas the bulb should be mounted about 500 mm from the vaporized refrigerant outlet connection. The pipe diameter between the expansion valve and the BHE should be the same as the diameter of the refrigerant liquid line. The vaporized refrigerant enters the heat exchanger at the bottom right connection and superheated gas leaves from the top right connection. The chilled water enters at the top left and leaves at the bottom left. To prevent freezing:

a) Use a filter < 1 mm, 16 mesh.
b) Use an antifreeze when the evaporation temperature is close to liquid-side freezing.
c) Use a freeze protection thermostat and flow switch to guarantee a constant water flow before, during and after compressor operation.
d) Avoid the "pump-down" function.
e) When starting up a system, wait a moment before starting the condenser (or have reduced flow through it).

1. Insulate unit to avoid condensation freezing on plate pack outer surface, if the operating temperatures are low.
2. Quick acting controls are best suited for use with the brazed plate.
3. **Evaporating** applications – position the expansion valve as close as possible to the liquid connection. The valve should be of a slightly higher capacity than the unit, and should have an external pressure equalizing connection to avoid unnecessary heating. The sensor bulb located on the suction side should be well insulated away from the ambient air temperature, and should be sensitive enough to respond quickly to changes in the gas temperature.

4. **Condensing** applications – regulate/control via/on the service medium circuit.

4.0 Warranty Statement

AIC's warranty obligations are limited to the terms set forth below:

Advanced Industrial Components ("AIC") warrants to the original purchaser that this product will be free of manufacturing defects in material and workmanship for a period of one (1) year from the original purchase date, or eighteen (18) months from AIC's original invoice, whichever expires first. The original purchase date as used herein shall mean the date stated in the vendor's original invoice.

AIC will, at its option, repair or replace this product without charge if it is found to be defective during the limited warranty period specified above. If AIC chooses, at its discretion, to replace any product for which there is a valid warranty claim, AIC shall replace the product with the same model or, if such model is not available, with a model which is, in AIC's reasonable judgment, the nearest compatible model available at the time of replacement. Note that each purchaser is limited to one (1) product replacement during the warranty period of the original claim.

NOT UNDER COVERAGE BY THIS WARRANTY

This limited warranty covers defects encountered in normal use of the product while operating according to the specifications set forth by AIC. The warranty is void and shall not apply to the following, including, but not limited to:

The failure or malfunction results from improper or negligent operation, abuse, misuse or maintenance or unauthorized alteration.
2. Malfunctions resulting from, or repairs necessitated by, uses of the product for purposes other than that for which it was designed, or resulting from flood, fire, wind, lightning, freezing, or any other natural disaster, an act of God, an act of destruction, theft, or accident.
3. Damages to the product that occur during shipment.
4. Damages caused by improper or faulty installation.
5. Products exposed to corrosive elements harmful to the structural integrity and durability of the product.
6. Products installed outside of Canada and the United States.

AIC shall not be liable for any direct, special, incidental, or consequential damages caused by the use, misuse, or inability to use this product. AIC is under no legal obligations to rectify, including but not limited to, lost profits, downtime, goodwill, damages to or replacement of equipment and property. Purchaser assumes all risk and liability for loss, damage or injury to purchaser and purchaser's property and to others and their property arising out of the use, misuse or inability to use this product. This limited warranty shall not extend to anyone other than the original purchaser of the product.

MAKING A WARRANTY CLAIM

Should your AIC Plate Heat Exchanger require warranty service, you should contact AIC at (905) 829-4666 for instructions on how to file your claim.

AIC RESERVES THE RIGHT TO CHANGE SPECIFICATIONS OR DISCONTINUE MODELS WITHOUT NOTICE.

ADVANCED INDUSTRIAL COMPONENTS INC.

2899 PORTLAND DRIVE
OAKVILLE, ONTARIO L6H-5S4
CANADA

TEL: (905) 829-4666 FAX: (905) 829-4646