Dakota County
Confidential

Scope of Work OUTLINE

Within this Scope of Work (SOW) the term ñBuyerò shall be construed to mean Dakota County, (DC) (hereinafter ñBuyerôs facilityò). The term ñSellerò shall be construed to mean vendor, supplier or bidder.

1 Buyer shall request an itemized quotation from Seller for the equipment and services listed in the SOW.

2 Should Seller determine any specific requirement or condition causes or contributes to a major design issue or substantial price increase, contact the Buyer immediately.

3 This SOW for the referenced equipment and services shall include the following:
Appendix A - Service/Equipment Specifications
Appendix B - Training
Appendix C - Preliminary Acceptance at DC
Appendix D - Installation
Appendix E - Required Documentation
Appendix F - Warranty

4 This procurement activity shall be conducted in three (3) distinct phases:

4.1 **Installation Review and Bid Procurement Phase** ð DC and Seller, if necessary, are to conduct an informal Installation Review prior to the final pricing and scope definition of proposed work. DC is not responsible for any assembly, rework or replacement costs associated with product(s) purchased, manufactured, modified or assembled prior to the award of contract to Seller.

4.2 **Preliminary Acceptance Phase** ð Before the installation and assembly of proposed work, Seller shall provide documentation of the work to be performed including the equipment specifications to be installed. The proposal must be approved and meet the Buyerôs specifications in accordance with Appendix C in this SOW

4.3 **Installation Phase** ð The proposed work shall be installed complete at DC's specified location in accordance with the requirements set out in Appendix D. Seller shall perform and guarantee equipment start-up and final commissioning as specified in Appendix D at Buyerôs facility.

5 **Final Acceptance Phase** ð Immediately after the completion of work at DCôs facility, Seller and/or DC shall complete a review of all work completed prior to Seller leaving Buyerôs facility.

6 Seller shall provide equipment as specified in Appendix A.

7 Seller will supply all proposal communications, documents and drawing information.

8 Travel Expenses. All travel expenses charges in the RFQ should include a line item for travel expenses. Any travel expenses billable against any resulting purchase order shall be approved in writing by Dakota County in advance, invoiced at cost, and based upon economy airfare, auto rental, hotel rates and reasonable meal charges.

9 Project Management:

9.1 Seller shall provide a Project Manager who will be responsible for coordinating the project, and for all amendments to and modifications of a purchase agreement in accordance with this SOW. The Project Manager will remain in this position from the start to the finish of the project unless both parties agree to a change.

9.2 Seller shall provide a manufacturing schedule/timeline at issue of purchase order. This schedule/timeline will become an element of the Contract and will be utilized in monitoring and evaluating Sellerôs performance.
9.3 Seller shall notify DC 2-wks in advance of the date for the Preliminary Acceptance Review.
9.4 After a Contract is released, all changes that are proposed to this SOW or the Specifications shall be issued in writing, signed, and dated by both the Project Manager for the Seller and the Buyer. If both parties agree upon the change, both parties shall sign and date the Approval section of the change request form. No changes are to be made without written approval of both parties.

Wescott Library Chiller Replacement Project	
Project Manager	Name ï Phone-Email
Buyer	
Expected Delivery Date	
Final Installed Location	Wescott Library, 1340 Wescott Rd, Eagan, MN 55123

APPENDIX A
SERVICE/EQUIPMENT PERFORMANCE SPECIFICATIONS

1 SCOPE OF WORK REQUESTED (Brief Overview)

Wescott Library Chiller Replacement Project

(1) Remove and replace (1) existing nominal 80-ton Air Cooled Chiller serving (1) existing air handler glycol cooling coil. Refer to manufacturer equipment literature for additional information on existing equipment. Existing R-22 refrigerant will be pumped out to a proper refrigerant cylinder and given to Dakota County.
(2) New equipment will be as follows:
    a. Performance of new unit to have equal to or higher nominal performance than that of existing Air-Cooled Chiller at 95 dgf entering condenser air temperature as listed on manufacturer data sheet for water.
    b. Unit to be provided with highest IEER available for nominal sized equipment with best practiced turndown capabilities on refrigerant compressors in this size range. Refrigerant selection will accommodate industry standards with respect to phase out planning and manufacturers requirements.
    c. New Air Cooled Chiller controller is to be provided with industry standard communication bus option for external supervisory controller data reading and writing.
    d. Evaporator selection of new chiller will not induce additional pressure drop than existing evaporator serving glycol pumping loop and air handlers glycol coils. Refer to existing Air-Cooled Chiller pressure drop data listed with this RFP.
(3) New chiller unit to have 460/3/60 electrical supply requirement as per existing. Include electrical disconnect and reconnect of HVAC equipment as necessary. Confirmation of existing conductor ampacities to be responsibility of contractor. Upgrade as needed
(4) Existing exterior space to be re-used for new equipment. Modification to existing equipment pad to be responsibility of HVAC contractor if necessary.

(5) New exterior glycol supply & return piping connections are to be mounted free standing and not to be supported from the new chiller.
(6) Existing glycol loop supply and return piping to existing Air-Cooled Chiller is to be cut back in a manner to best accommodate the piping connections of the new chiller. Refer to manufacturer Application Consideration sheet included with this RFP. Any piping specialty devices that are either a part of the existing chiller or part of the piping being removed are to be re-installed or replaced with new to accommodate the new piping connections.
(7) New chiller system will be installed to account for all performance requirements as set forth by manufacturer. See existing chiller application data for reference.
(8) Piping insulation for all new piping and patching of existing to be included. Insulation material to match existing.
(9) Draining and filling of glycol system as needed is included in this scope of work. Any glycol solution used to refill the system will match existing percent concentration and be treated per industry standards and best practices. Testing of new glycol to be at proper chemical levels to be included in this scope of work.
(10) Remove and replace existing glycol pumps P-1 & P-2 like for like. See existing pump information included with this correspondence for reference.
(11) Remove and replace existing glycol pump discharge triple duty valves. Remove and replace existing expansion tank. See existing equipment information included with this correspondence for reference.
(12) Remove and replace existing AHU (40) HP supply fan and (15) HP return fan blower motors with hi efficiency motors. Furnish and install new sheaves and belts for each new motor. Existing motor information is included with this correspondence for reference.
(13) For each new blower motor replaced above, furnish and install new ABB drive for applicable voltage & HP duty. Include VFD bypass option. Include new disconnects as necessary. Furnish new grounding straps for new VFD controlled motors if necessary.
(14) HVAC contractor is to contract with local Alerton controls contractor to have all the existing Air-Cooled Chiller control system functionality replicated per Dakota County approval. Any control sensors, thermometers, flow switches and/or pressure gages located on the existing Air-Cooled Chiller or in the existing glycol piping being disconnected and reconnected are to be removed and re-installed in the new equipment or piping. If said sensors, thermometers flow switches and/or pressure gages are damaged during demolition or upon inspection deemed beyond their useful life, contractor is to notify Dakota County personnel and obtain approval for replacement of like for like components prior to installation of new components. Reconnection of control wiring of any sensors or actuators is also to be included in this scope of work.
(15) Tie-in of new equipment, temporary shutdown of existing equipment for work, and generally any noisy work is to be coordinated with and approved by DC building operator prior to work proceeding. Workers may start at 6:00 am to complete these tasks on straight time.
(16) Manufacture certified training of DC on-site personnel, if required to maintain warranty, is to be included under this work.
(17) Freight, receiving, rigging and setting into place to be included
(18) Remove from site debris created from this project.
(19) Taxes, required permits including PE stamp if required, and warranty to be included.
(20) This entire Scope of Work is to be considered turnkey, all inclusive for a complete project.

(21) Include any and all utility rebate paperwork and forms necessary to process applicable rebates and/or credits on behalf of DC.

2 REFERENCE DOCUMENTS

2.1 Seller to request any DC documents required prior to Installation and Service.

2.2 Industry References

2.2.1 ANSI/ASHRAE STANDARD 15-2019 - Safety Code for Mechanical Refrigeration.
2.2.2 ASHRAE 90.1-2019 - Energy Conservation in New Building Design.
2.2.3 ASME SEC VIII - Boiler and Pressure Vessel Code.
2.2.4 ANSI/UL 465 - Central Cooling Air Conditioners.
2.2.5 AHRI STANDARD 550/590-2020 - Centrifugal, Helical rotary, scroll, and reciprocating water chillers.
2.2.6 AHRI Standard 575-2017 Sound.
2.2.7 AFBMA 9-2015 - Load Ratings and Fatigue Life of Roller Bearings.
2.2.8 ASHRAE STANDARD 34-2019 - Number Designation and Safety Classification of Refrigerants.
2.2.9 ANSI/ASHRAE Standard 147-2013 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems.
2.2.10 2020 Minnesota State Mechanical and Fuel Gas Code
2.2.11 NFPA 70 ï 2020 NEC
2.2.12 UL508A 2018

2.3 Industry Regulatory and Compliance Requirements

2.3.1 Conform to AHRI Standard 550/590-2020 code for rating and testing of equipment.
2.3.2 Conform to UL 1995 for Safety for Heating and Cooling Equipment.
2.3.3 Conform to ANSI/ASME SECTION VIII Boiler and Pressure Vessel Code for construction and testing of equipment as applicable.
2.3.4 Conform to ANSI/ASHRAE STANDARD 15-2019 code for construction and operation of HVAC equipment.
2.3.5 Unit shall bear the AHRI Certification Label for the specific type of unit as applicable.

3 BUYER-SUPPLIED INFORMATION

3.1 Existing Available Drawings

4 SELLER PROVIDED INFORMATION (Specify "N/A" if not applicable.)

4.1 Wescott Library Chiller Replacement Project Pricing: (Please price separately)

4.1.1 Turnkey project pricing Replacement _____

4.1.2 Option: Labor Rate for out of scope work _____

4.1.3 Option: Recommended Spares/Repair Kit _____

This kit should be based upon the availability/lead-time of critical parts or elements and their anticipated failure rates. Please indicate estimated pricing and lead-time for each P/N.

4.2 On-site Installation Time Requirements _____

4.3 Availability Installation dates _____

4.4 As built drawings, Operation and Maintenance manuals (2 copies). See Appendix E below.

APPENDIX B
TRAINING REQUIRENMENTS

Seller shall provide training as specified in Appendix A for Buyerôs employees in all subject areas of operation, including, but not limited to, mechanical, electrical maintenance, operating and programming. The training is to be given during the installation period.

APPENDIX C
PRELIMINARY ACCEPTANCE PHASE

1.0 Before the service and installation at the Buyerôs facility, the Seller shall conduct a meeting describing in detail the work to be performed, the equipment and materials to be installed, and the necessary preparation requirements of the Buyer.

2.0 Seller must notify Buyer in writing of the scheduled date for installation at Buyerôs facility three (3) weeks in advance of such date.

3.0 Buyer will provide its approval (in writing), upon satisfactory completion of the preliminary runoff.

APPENDIX D
INSTALLATION

1.0 SELLER'S INSTALLATION RESPONSIBILITIES

1.1. Seller shall provide the following for installation of the Wescott Library Chiller Replacement Project work:

1.1.1. Licensed qualified installation personnel provided by Seller or representative.

1.1.2. Installation schedule to be supplied with installation instructions. Schedule to be reviewed and approved by Buyer prior to installation.

1.1.3. Seller shall be responsible for initial powering up, initial programming, commissioning and debugging of system.

2.0 BUYER'S INSTALLATION RESPONSIBILITIES

2.1. Buyer shall supply the following for the installation of the Wescott Library Chiller Replacement Project work:

2.1.1. Supervision and personnel to assist Sellers Service Technicians with scope of work that would be considered reasonable assistance in the interest of both parties.

APPENDIX E
REQUIRED DOCUMENTATION

1.0 Operator manuals

2.0 Maintenance Manuals

- 2.1 Instructions
- 2.2 Schedule

3.0 Functional / Technical Manual

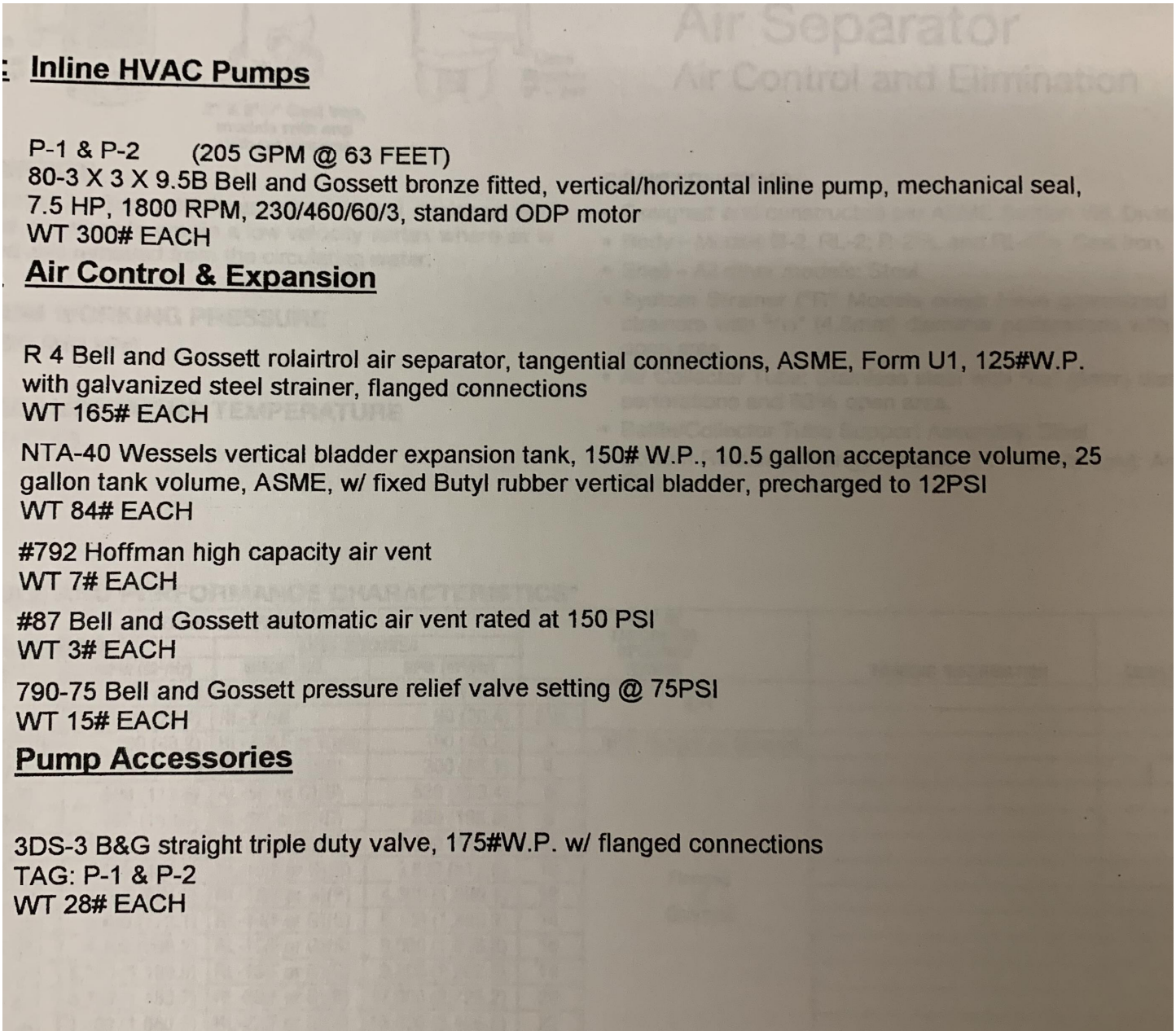
- 3.1 Functional Overview
- 3.2 Cut Sheets and Component documentation

4.0 Documentation. (Seller must provide Electronic (DWG Readable) and Hard Copy (paper) Documentation. Buyer prefers to receive one complete set of equipment documentation in the Electronic format, plus one set of the piping/electrical wiring schematics in hard copy/paper format to accompany the machinery.)

- 4.4.1 CD-ROM or Flash Drive copy of all installed Operating Systems, programs, applications & instructions.
- 4.4.2 One (1) complete set of installation/foundation prints and instructions supplied two (2) months before installation.
- 4.4.3 Two (2) complete sets of pneumatic, electrical, and hydraulic schematics.
- 4.4.4 Two (2) complete sets of maintenance and operator instruction manuals.
- 4.4.5 Complete part listing with part number, vendor identification, source and acquisition lead-time.
- 4.4.6 Preventative maintenance schedule.

APPENDIX F
WARRANTY

1.0 Seller guarantees and warrants that all equipment purchased in accordance with this SOW shall have a minimum standard warranty length of twelve (12) months from the date of final written acceptance of the project at Buyerôs facility, and additional (5) year warranty on any refrigerant compressor provided will either be included in base scope or offered as an add option to base scope of work.



Inline HVAC Pumps

P-1 & P-2 (205 GPM @ 63 FEET)
80-3 X 3 X 9.5B Bell and Gossett bronze fitted, vertical/horizontal inline pump, mechanical seal, 7.5 HP, 1800 RPM, 230/460/60/3, standard ODP motor
WT 300# EACH

Air Control & Expansion

R 4 Bell and Gossett rolairtrol air separator, tangential connections, ASME, Form U1, 125#W.P. with galvanized steel strainer, flanged connections
WT 165# EACH

NTA-40 Wessels vertical bladder expansion tank, 150# W.P., 10.5 gallon acceptance volume, 25 gallon tank volume, ASME, w/ fixed Butyl rubber vertical bladder, precharged to 12PSI
WT 84# EACH

#792 Hoffman high capacity air vent
WT 7# EACH

#87 Bell and Gossett automatic air vent rated at 150 PSI
WT 3# EACH

790-75 Bell and Gossett pressure relief valve setting @ 75PSI
WT 15# EACH

Pump Accessories

3DS-3 B&G straight triple duty valve, 175#W.P. w/ flanged connections
TAG: P-1 & P-2
WT 28# EACH

Miscellaneous glycol equipment to be replaced.

Model Number Description

Existing Chiller Data Sheet

Model Nomenclature
Digit Number

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
R	T	A	A	0	8	0	4	X	L	0	1	A	3	D	0	B

Existing Wescott Library Chiller Nameplate

70-125 Tons

Digits 1,2 — Unit Model
** RT = Rotary Chiller

Digit 3 — Unit Type
** A = Air Cooled

Digit 4 — Development Sequence
** A = First Sequence

Digit 5, 6 & 7 — Nominal Capacity
070 = 70 tons
** 080 = 80 tons
090 = 90 tons
100 = 100 tons
110 = 110 tons
125 = 125 tons

Digit 8 — Unit Voltage
A = 200/60/3
C = 230/60/3
D = 380/60/3
** 4 = 460/60/3
5 = 575/60/3
S = Special

Digit 9 — Compressor Starter Type
Y = Y-Delta Closed Transition
** X = X-Line (Across the Line)
S = Special

Digit 10, 11 — Design Sequence
** = Factory Input

Digit 12 — Evaporator Leaving Temperature
** 1 = Standard 40 to 65 F
2 = Low 0 to 39 F
3 = Ice-Making 20 to 65 F
S = Special

Digit 13 — Condenser Coil Fin Material
** A = Aluminum
S = Special

Digit 14 — Agency Listing
0 = No Agency Listing
1 = C/UL Listing

Digit 15 — Control Interface
C = Deluxe without Communication
** D = Deluxe with Communication

Digit 16 — Chilled Water Reset
** 0 = No Chilled Water Reset
1 = Based on Return Water Temperature
2 = Based on Outside Air Temperature

Digit 17 — Miscellaneous Factory Installed Options
A = Architectural Louvered Panels
** B = Control Power Transformer
D = Low Ambient Lockout Sensor
F = Mech. Disconnect Switch
G = Low Ambient Operation
K = Coil Protection
M = Access Guard
P = Circuit Breaker (Single Point Power)
Z = Circuit Breaker (Dual Point Power)

Field Installed Options
Q = Spring Isolators
N = Neoprene Isolators
R = Remote Display Panel
3 = 5 Year Compressor Warranty
8 = Architectural Louvered Panels
9 = Coil Protection
0 = Access Guard
J = Remote Evaporator
H = Sound Attenuator

130-400 Tons

Digits 1, 2 — Unit Model
RT = Rotary Chiller

Digit 3 — Unit Type
A = Air Cooled

Digit 4 — Development Sequence
A = First Sequence

Digit 5, 6 & 7 — Nominal Capacity

130	= 130 tons	240	= 240 tons
140	= 140 tons	270	= 270 tons
155	= 155 tons	300	= 300 tons
170	= 170 tons	340	= 340 tons
185	= 185 tons	370	= 370 tons
200	= 200 tons	400	= 400 tons
215	= 215 tons		

Digit 8 — Unit Voltage
G = 200-230/60/3 Dual Voltage
K = 380-415/50/3 Dual Voltage
4 = 460/60/3
5 = 575/60/3
S = Special
D = 380/60/3

Digit 9 — Compressor Starter Type
Y = Y-Delta Closed Transition
X = X-Line (Across the Line)
S = Special

Digit 10, 11 — Design Sequence
** = Factory Input

Digit 12 — Evaporator Leaving Temperature
1 = Standard 40 to 65 F
2 = Low 0 to 39 F
3 = Ice-Making 20 to 65 F
S = Special

Digit 13 — Condenser Coil Fin Material
A = Aluminum
S = Special

Digit 14 — Agency Listing
0 = No Agency Listing
1 = C/UL Listing

Digit 15 — Control Interface
C = Deluxe without Communication
D = Deluxe with Communication

Digit 16 — Chilled Water Reset
0 = No Chilled Water Reset
1 = Based on Return Water Temperature
2 = Based on Outside Air Temperature

Digit 17 — Miscellaneous Factory Installed Options
A = Architectural Louvered Panels
B = Control Power Transformer
C = Domestic Water Heater
D = Low Ambient Lockout Sensor
F = Mech. Disconnect Switch
G = Low Ambient Operation
K = Coil Protection
M = Access Guard
P = Circuit Breaker (Single Point Power)
Z = Circuit Breaker (Dual Point Power)

Field Installed Options
2 = Remote Display Panel
5 = 5 Year Compressor Warranty
N = Neoprene Isolators
6 = Spring Isolators
7 = Architectural Louvered Panels
J = Remote Evaporator
8 = Coil Protection
9 = Access Guard
H = Sound Attenuator

General Data

Table G-1 — General Data RTAA — 70-125 Ton

Size		70	80	90	100	110	125
Compressor							
Quantity		2	2	2	2	2	2
Nominal Size (1)	(Tons)	35/35	40/40	50/40	50/50	60/50	60/60
Evaporator							
Water Storage	(Gallons)	39.8	37.3	34.4	32.1	53.4	45.8
	(Liters)	150.6	143.1	130.2	121.5	202.11	173.4
Min. Flow	(GPM)	84	96	108	120	132	150
	(L/Sec)	5.3	6.1	6.8	7.6	8.3	9.5
Max. Flow	(GPM)	252	288	324	360	396	450
	(L/Sec)	15.9	18.2	20.4	22.7	25.0	28.4
Condenser							
Qty of Coils		4	4	4	4	4	4
Coil Length	(In)	156/156	156/156	168/156	168/168	204/168	204/204
Coil Height	(In)	42	42	42	42	42	42
Fins/Ft.		192	192	192	192	192	192
Number of Rows		2	2	2	2	2	2
Condenser Fans							
Quantity (1)		4/4	4/4	5/4	5/5	5/5	5/5
Diameter	(In)	30	30	30	30	30	30
Total Airflow	(CFM)	71750	71750	77640	83530	87505	91480
Nominal RPM		850	850	850	850	850	850
Tip Speed	(Ft/Min)	6675	6675	6675	6675	6675	6675
Motor HP (Ea)		1.0	1.0	1.0	1.0	1.0	1.0
Min Starting/Oper Ambient (2)							
Std Unit	(Deg F)	25	25	25	25	25	25
Low Ambient	(Deg F)	-10	-10	-10	-10	-10	-10
General Unit							
Refrigerant		HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22
No. of Independent Refrigerant Circuits		2	2	2	2	2	2
% Min. Load (3)		15	15	15	15	15	15
Refrigerant Charge (1)	(Lb)	58/58	61/61	73/61	73/73	98/73	98/98
	(Kg)	26/26	28/28	34/28	34/34	44/34	44/44
Oil Charge (1)	(Gallons)	2.5/2.5	2.5/2.5	3/2.5	3/3	3/3	3/3
	(Liters)	10.6/10.6	10.6/10.6	12.7/10.6	12.7/10.6	12.7/12.7	12.7/12.7

Table G-2 — General Data RTAA — 130-215 Ton

Size		130	140	155	170	185	200	215
Compressor								
Quantity		2	2	2	2	2	2	2
Nominal Size (1)	(Tons)	70/70	70/70	85/70	100/70	100/85	100/100	100/100
Evaporator								
Water Storage	(Gallons)	49	46	73	69	62	61	100
	(Liters)	184	175	277	261	234	231	378.5
Min. Flow	(GPM)	156	156	186	186	222	222	258
	(L/Sec)	9.8	9.8	11.7	11.7	14.0	14.0	16.27
Max. Flow	(GPM)	504	504	612	612	720	720	774
	(L/Sec)	31.8	31.8	38.6	38.6	45.4	45.4	48.82
Condenser								
Qty of Coils		4	4	4	4	4	4	4
Coil Length	(In)	214/214	214/214	240/214	240/214	240/240	240/240	240/240
Coil Height	(In)	42	42	42	42	42	42	42
Fins/Ft.		156	156	156	156	156	156	156
Number of Rows		3	3	3	3	3	3	3
Condenser Fans								
Quantity (1)		5/5	5/5	6/5	7/5	7/6	7/7	7/7
Diameter	(In)	30	30	30	30	30	30	30
Total Airflow	(CFM)	105,860	105,860	114,610	120,160	128,910	134,460	134,460
Nominal RPM		1140	1140	1140	1140	1140	1140	1140
Tip Speed	(Ft/Min)	8954	8954	8954	8954	8954	8954	8954
Motor HP (Ea)		1.5	1.5	1.5	1.5	1.5	1.5	1.5
Min Starting/Oper Ambient (2)								
Std Unit	(Deg F)	15	15	15	15	15	15	15
Low Ambient	(Deg F)	0	0	0	0	0	0	0
General Unit								
Refrigerant		HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22
No. of Independent Refrigerant Circuits		2	2	2	2	2	2	2
% Min. Load (3)		10	10	10	10	10	10	10
Refrigerant Charge (1)	(Lb)	130/130	130/130	165/130	170/130	170/165	170/170	190/190
	(Kg)	59/59	59/59	75/59	77/59	77/75	77/77	86/86
Oil Charge (1)	(Gallons)	7/7	7/7	8/7	8/7	8/8	8/8	8/8
	(Liters)	27/27	27/27	30/27	30/27	30/30	30/30	30/30

Notes:
1. Data containing information on two circuits shown as follows: ckt1/ckt2
2. Minimum start-up/operating ambient based on a 5 mph wind across the condenser.
3. Percent minimum load is for total machine at 50 F ambient and 44 F LWT, not each individual circuit.

Application Considerations

Typical Water Piping
All building water piping must be flushed prior to making final connections to the chiller. To reduce heat loss and prevent condensation, insulation should be installed. Expansion tanks are also usually required so that chilled water volume changes can be accommodated. A typical piping arrangement is shown in Figure A-1.

Short Water Loops
The proper location of the temperature control sensor is in the supply (outlet) water. This location allows the building to act as a buffer and assures a slowly changing return water temperature. If there is not a sufficient volume of water in the system to provide an adequate buffer, temperature control can be lost, resulting in erratic system operation and excessive compressor cycling. A short water loop has the same effect as attempting to control from the building return water.

As a guideline, ensure the volume of water in the evaporator loop equals or exceeds two times the evaporator flow rate. For a rapidly changing load profile, the amount of volume should be increased.

To prevent the effect of a short water loop, the following items should be given careful consideration:

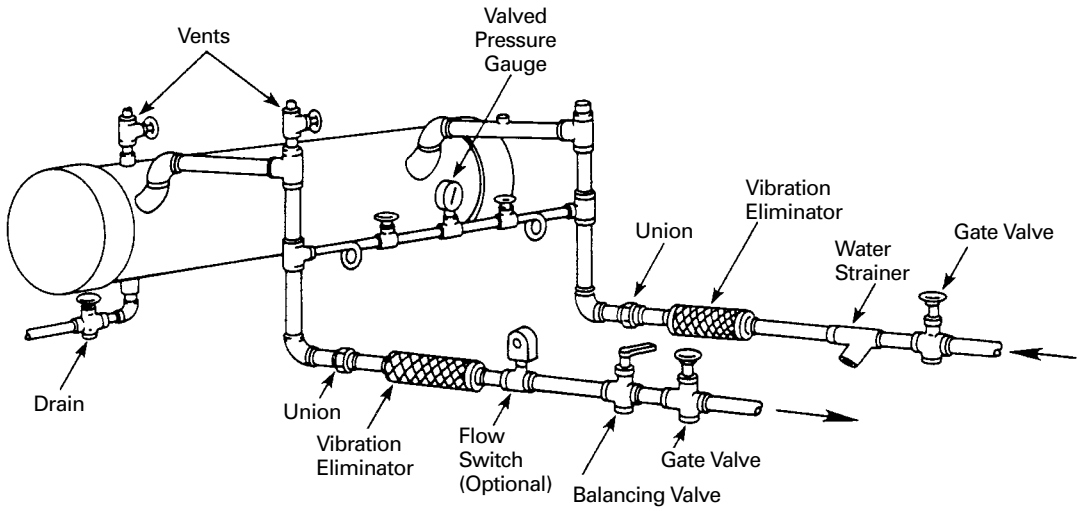
A storage tank or larger header pipe to increase the volume of water in the system and, therefore, reduce the rate of change of the return water temperature.

Multiple Unit Operation
Whenever two or more units are used on one chilled water loop, Trane recommends that their operation be controlled from a single control device, such as a Trane Tracer® system.

1
Series Operation
Some systems require large chilled water temperature drops (16 to 24 F). For those installations, two units with their evaporators in series are usually required. Control of the units should be from a common temperature controller to prevent the separate thermostats fighting one another and continually hunting. It is possible to control from the two individual unit controls, but a common temperature controller provides a positive method for preventing control overlap, more closely matches system load, and simplifies compressor lead-lag capability.

2
Parallel Operation
Some systems require more capacity or standby capability than a single machine can provide. For those installations, two units with their evaporators in a parallel configuration are typical. The only effective way of controlling two units in parallel is with a single temperature controller. Two individual temperature controllers are not capable of providing reliable system control and will often result in unsatisfactory operation and possible compressor failure.

Figure A-1 — Recommended Piping Components For Typical Evaporator Installation



Performance Adjustment Factors

Table F-1 — Performance Data Adjustment Factors

Fouling Factor	Chilled Water Temp. Drop	Altitude											
		Sea Level			2000 Feet			4000 Feet			6000 Feet		
		CAP	GPM	KW	CAP	GPM	KW	CAP	GPM	KW	CAP	GPM	KW
0.00010	8	1.000	1.249	1.000	0.996	1.245	1.004	0.991	1.240	1.007	0.987	1.234	1.014
	10	1.000	1.000	1.000	0.997	0.996	1.004	0.993	0.992	1.007	0.988	0.988	1.015
	12	1.001	0.835	1.001	0.997	0.832	1.004	0.993	0.828	1.009	0.988	0.824	1.015
	14	1.003	0.716	1.001	0.999	0.714	1.004	0.994	0.711	1.009	0.990	0.708	1.015
	16	1.004	0.628	1.001	1.000	0.626	1.005	0.997	0.623	1.009	0.991	0.620	1.016
0.00025	8	0.988	1.235	0.996	0.984	1.230	1.000	0.980	1.225	1.004	0.975	1.220	1.010
	10	0.988	0.989	0.998	0.986	0.985	1.000	0.981	0.981	1.004	0.977	0.976	1.011
	12	0.990	0.825	0.998	0.987	0.822	1.000	0.983	0.819	1.005	0.978	0.815	1.011
	14	0.991	0.708	0.998	0.988	0.706	1.001	0.984	0.703	1.005	0.980	0.700	1.011
	16	0.993	0.621	0.999	0.990	0.619	1.001	0.986	0.617	1.006	0.981	0.614	1.012

Existing chiller 80 ton at 175 gpm yields 10.0 ft +/- across evaporator

Figure F-1 — Evaporator Water Pressure Drops, 70-125 Ton Units

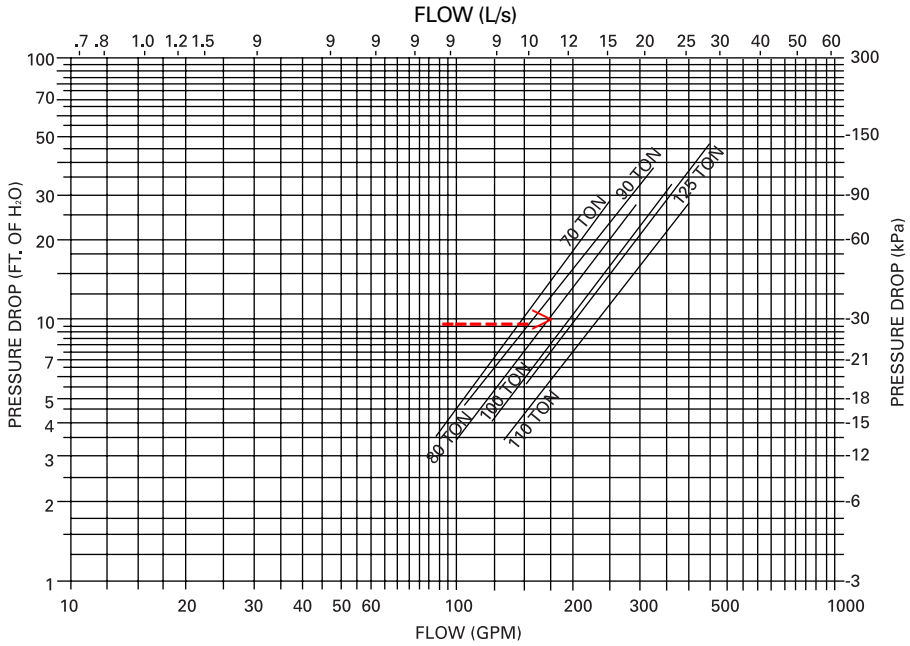


Figure F-2 — Evaporator Water Pressure Drops, 130-400 Ton Units