APPENDIX A

DESIGN CALCULATIONS

CONESTOGA-ROVERS & ASSOCIATES

PROJECT No.: 6883-10

PROJECT NAME: HICKSVILLE

DESIGNED BY: JGRW

DATE: 2/15/05

CHECKED BY:

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COMPRESSOR SIZING (NORMAL OPERATION)

MAXIMUM AIR USAGE ⇒ 100 SCFM FOR 16 HOURS PER POINT PER MONTH

WELLS ⇒ 22 (10 MIDDLE, 12 NORTH)
2 POINTS (MAX.) PER WELL

TOTAL POINTS ⇒ 22 X 2 = 44 POINTS (MAX)

100 SCFM COMPRESSOR ⇒ 16 HOURS X 44 POINTS = 704 HRS./MONTH (@ 100 SCFM)
= 29 DAYS

29 DAYS = 0.97 MONTHS

∴ NEED ~97 SCFM COMPRESSOR TO ACCOMPLISH AIR DEMAND IN ONE MONTH.

* SEE ALTERNATE CALCULATION FOR WORST CASE AIR CONSUMPTION.

Compressor Sizing (Alternate Calculation)

The worst case situation would be for the month in which the north fence becomes operational because:

i) the entire middle fence (10 wells = 20 injection points) will be operational at that time (2 monthly injections);

ii) an initial 40 hours of injection will be needed for the 12 wells (24 injection points) for the north fence; and

iii) one of the 2 monthly injections will be performed for the north fence.

The volume of air to be injected for the above three items are:

i) Middle Fence Continuous Operation (2 injection events/month)

20 injection points x 100 scfm x 8 hrs/event x 60 min/hr x 2 events = 1,920,000 scf

ii) North Fence Startup

24 injection points x 100 scfm x 40 hrs x 60 min/hr = 5,760,000 scf

iii) North Fence Continuous Operation (1 injection event)

24 injection points x 100 scfm x 8 hrs/event x 60 min/hr = 1,152,000 scf
Thus, the total worst case situation for an entire month = 8,832,000 scf

The monthly capacity of the 300 scfm compressor is:

300 scfm x 30 days x 1440 min/day = 12,960,000 scf

Thus, for the worst case situation, only 68 percent of the compressor capacity will be used. Consequently, the compressor is adequately sized.

CONESTOGA-ROVERS & ASSOCIATES

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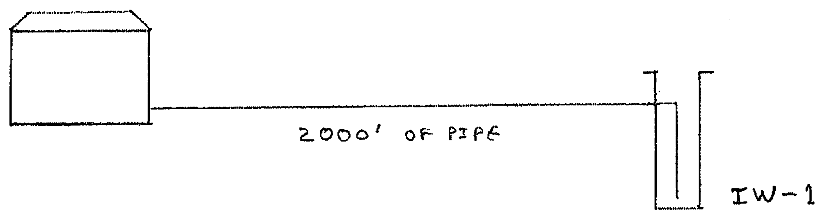
PIPING PRESSURE LOSSES



SUPPLEMENT LINE ⇒ 1½" LINE
25 GPM (MAX.)
ΔP (PER 100') = 6.32' = 2.73 psi

2000' ⇒ 2.73 x 20 = 54.6 psi
OTHER PIPE ⇒ 5 psi
* TOTAL = 59.6 psi @ 25 GPM
* TOTAL = 40.9 psi @ 20 GPM

∴ IF SUPPLIED WATER PRESSURE IS LESS THAN 60 psi, WATER WILL BE INJECTED AT 20 GPM MAXIMUM.

AIR LINE ⇒ MOST SHALLOW WELL IS 245' bgs.
WATER LEVEL IS 50' bgs.
AIR MUST OVERCOME 195' = 84 psi
ΔP OF PIPE (FORCEMAIN) ⇒ 0.078 (20.0) = 1.56 psi (WORST CASE 300SCFM)

DEEPEST WELL ⇒ 415'
⇒ WATER COLUMN = 415-50 = 365' = 158 psi

ΔP OF PIPE IN WELL ⇒ 4.15 X 2.21 = 9 psi

ΔP FILTERS, ETC ⇒ 5 psi

ΔP_{TOTAL} (WORST CASE) ⇒ 1.4 + 158 + 9 + 5 = 173.4 psi

COMPRESSED AIR DISTRIBUTION PIPING

The compressed air distribution piping will be designed and installed in accordance with the ASME/ANSI B31.1 Power Piping Code. This code is intended to assure safety and reliability of high pressure piping systems, particularly for compressed gases where failure can result in substantial damage or injury.

The piping material will be ASTM A53 Grade B, Schedule 80, Type E or S carbon steel with butt welded joints and fittings. The piping design pressure will be 200 pounds per square inch gauge (PSIG) to be consistent with the system pressure relief device(s). For the underground portion, the piping exterior will be wrapped with a corrosion resistant adhesive covering (Tapecoat or equal).

Alternate materials of construction for the underground piping were considered and rejected.

Thermoplastic pipe such as polyvinyl chloride (PVC) and high density polyethylene (HDPE) were considered due to exceptional corrosion resistance in ground contact. The pressure rating of the field joints however would not provide an acceptable safety factor, considering the long lengths and large number of field joints required. Any in-ground leak would be very difficult to find and repair. In addition, PVC and HDPE are non-ductile materials. Therefore, collateral loads imposed on the pipe could cause rupture that would not occur in a ductile material such as carbon steel.

Ductile iron pipe was also considered due to excellent corrosion resistance in ground contact. The major disadvantage of ductile iron pipe is the joining method. All joining methods, including victaulic couplings, flanges, and mechanical joints, rely on elastomeric gaskets and bolted hardware to maintain pressure tight seals. These methods have proven to be reliable (although not without leakage) in municipal water systems at 60 to 80 PSIG. Transmission of air at up to 200 PSIG is not a common or recommended use of ductile iron pipe and fittings. The bolting materials used to join the pipe could also be subject to long term deterioration.

Carbon steel distribution piping is recommended due to its high pressure rating, high safety factor, exceptional ductility, and reliability of joining method (welding).

CONESTOGA-ROVERS & ASSOCIATES	PROJECT No.: 006883-10	DATE: 10/28/03
	PROJECT NAME: HICKSVILLE BIOSPARGE	CHECKED BY:
	DESIGNED BY: WJK	PAGE 1 OF 2

DESIGN CRITERIA FOR COMPRESSED AIR PIPING & VALVES

REF: ASME B31.3 CODE FOR PRESSURE PIPING

1. PRESSURE PIPING (ASTM A53, GRADE B CARBON STEEL)

P = INTERNAL DESIGN PRESSURE = 200 PSIG = RELIEF VALVE SETTING

D = O.D. OF PIPE = 3.5 IN. (FOR 3"ϕ STEEL PIPE)

S = ALLOWABLE STRESS (SEE TABLE A-1) = 20,000 PSI (FOR T < 200°F)

E = WELDED JOINT EFFICIENCY (SEE TABLE A-1B) = 0.85 FOR TYPE ERW PIPE

Y = DIMENSIONLESS COEFFICIENT (SEE TABLE 304.1.1) = 0.4 FOR FERRITIC STEELS @ T < 900°F

t = MINIMUM REQUIRED PIPE WALL THICKNESS

$$= \frac{PD}{2(SE + PY)} \quad \text{(SEE SECT. 304.1.2)}$$

$$= \frac{(200)(3.5)}{2[(20{,}000)(.85)+(200)(.4)]} = 0.02 \text{ INCHES}$$

T = SPECIFIED WALL THICKNESS (SCH. 80) = 0.30 INCHES

2. FLANGES

- CLASS 150 SUFFICIENT (SEE TABLE G-150), CAPACITY = 256 PSI

3. VALVES (BALL & BUTTERFLY TYPE)

MATERIAL OF CONSTRUCTION - ASTM A216, GRADE WCB CARBON STEEL

GENERAL PRESSURE RATING PER ANSI B16.34

- FOR CLASS 150 VALVES = 260 PSIG @ 200°F MAX. BODY RATING

  & 260 PSIG @ 200°F MAX SEAT RATING FOR BUTTERFLY VALVES but may be used for a special or more rigorous design of components covered by para. 302.2 or A302.2. Designs shall be checked for adequacy of mechanical strength under applicable loadings enumerated in para. 301.

304 PRESSURE DESIGN OF METALLIC COMPONENTS

304.1 Straight Metallic Pipe

304.1.1 General

(a) The required thickness of straight sections of pipe shall be determined in accordance with Eq. (2):

$$t_m = t + c \tag{2}$$

The minimum thickness for the pipe selected, considering manufacturer's minus tolerance, shall be not less than t_m.

(b) The following nomenclature is used in the equations for pressure design of straight pipe.

t_m = minimum required thickness, including mechanical, corrosion, and erosion allowances

t = pressure design thickness, as calculated in accordance with para. 304.1.2 for internal pressure or as determined in accordance with para. 304.1.3 for external pressure

c = the sum of the mechanical allowances (thread or groove depth) plus corrosion and erosion allowances. For threaded components, the nominal thread depth (dimension h of ANSI/ASME B1.20.1, or equivalent) shall apply. For machined surfaces or grooves where the tolerance is not specified, the tolerance shall be assumed to be 0.02 in. (0.5 mm) in addition to the specified depth of the cut.

d = inside diameter of pipe. For pressure design calculation, the inside diameter of the pipe is the maximum value allowable under the purchase specification.

P = internal design gage pressure

D = outside diameter of pipe

E = quality factor from Table A-1A or A-1B

S = stress value for material from Table A-1

T = pipe wall thickness (measured or minimum per purchase specification)

Y = coefficient from Table 304.1.1, valid for $t < D/6$ and for materials shown. The value of Y may be interpolated for intermediate temperatures. For $t \geq D/6$,

TABLE 304.1.1
VALUES OF COEFFICIENT Y
FOR $t < D/6$

Materials	Temperature, °F (°C)					
	900 (482) & lower	950 (510)	1,000 (538)	1,050 (566)	1,100 (593)	1,150 (621) & up
Ferritic steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic steels	0.4	0.4	0.4	0.4	0.5	0.7
Other ductile metals	0.4	0.4	0.4	0.4	0.4	0.4
Cast iron	0.0	...	...	...	...	...

$$Y = \frac{d + 2c}{D + d + 2c}$$

304.1.2 Straight Pipe Under Internal Pressure

(a) For $t < D/6$, the internal pressure design thickness for straight pipe shall be not less than that calculated in accordance with Eq. (3a):

$$t = \frac{PD}{2(SE + PY)} \tag{3a}$$

Equation (3b), (3c), or (3d) may be used instead of Eq. (3a):

$$t = \frac{PD}{2SE} \tag{3b}$$

$$t = \frac{D}{2}\left(1 - \sqrt{\frac{SE - P}{SE + P}}\right) \qquad \text{(Lamé Equation) (3c)}$$

$$t = \frac{P(d + 2c)}{2[SE - P(1 - Y)]} \tag{3d}$$

(b) For $t \geq D/6$ or for $P/SE > 0.385$, calculation of pressure design thickness for straight pipe requires special consideration of factors such as theory of failure, effects of fatigue, and thermal stress.

304.1.3 Straight Pipe Under External Pressure. To determine wall thickness and stiffening requirements for straight pipe under external pressure, the procedure outlined in the BPV Code, Section VIII, Division 1,

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS[1]
Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Material	Spec. No.	P-No. (5)	Grade	Notes	Min. Temp., °F (6)	Specified Min. Strength, ksi Tensile	Yield	Min. Temp. to 100	200	300
Carbon Steel (Cont'd)										
Pipes and Tubes (2) (Cont'd)										
. . .	A 53	1	B	(57) (59)	−20					
. . .	A 106	1	B	(57)	−20					
. . .	A 333	1	6	(57)	−50					
. . .	A 334	1	6	(57)	−50	60	35	20.0	20.0	20.0
. . .	A 369	1	FPB	(57)	−20					
. . .	A 381	SP1	Y35	(51)	−20					
. . .	API 5L	1	B	(57) (59)	−20					
. . .	A 139	1	C	(8b)	−20	60	42			
. . .	A 139	1	D	(8b)	−20	60	46	20.0	20.0	20.0
. . .	API 5L	SP2	X42	(51) (55)	−20	60	42	20.0	20.0	20.0
. . .	A 381	SP2	Y42	(51)	−20	60	42	20.0	20.0	20.0
(> 3/8 in. thick)	A 381	SP3	Y48	(51)	−20	62	48	20.6	19.7	18.7
. . .	API 5L	SP3	X46	(51) (55)	−20	63	46	21.0	21.0	21.0
. . .	A 381	SP3	Y46	(51)	−20	63	46	21.0	21.0	21.0
(> 3/8 in. thick)	A 381	SP3	Y50	(51)	−20	64	50	21.3	20.3	19.3
A 516 Gr. 65	A 671	1	CC65	(57) (67)	−20	65	35	21.7	21.3	20.7
A 515 Gr. 65	A 671	1	CB65							
A 515 Gr. 65	A 672	1	B65	(57) (67)	−20	65	35	21.7	21.3	20.7
A 516 Gr. 65	A 672	1	C65							
. . .	A 139	1	E	(8b)	−20	66	52	22.0	22.0	22.0
. . .	API 5L	SP3	X52	(51) (55)	−20	66	52	22.0	22.0	22.0
(> 3/8 in. thick)	A 381	SP3	Y52	(51)	−20	66	52	22.0	22.0	22.0
A 516 Gr. 70	A 671	1	CC70	(57) (67)	−20	70	38	23.3	23.1	22.5
A 515 Gr. 70	A 671	1	CB70							
A 515 Gr. 70	A 672	1	B70	(57) (67)	−20	70	38	23.3	23.1	22.5
A 516 Gr. 70	A 672	1	C70							
. . .	A 106	1	C	(57)	−20	70	40	23.3	23.3	23.3
A 537 Cl. 1 (≤ 2½ in. thick)	A 671	1	CD70							
A 537 Cl. 1 (≤ 2½ in. thick)	A 672	1	D70	(67)	−20	70	50	23.3	23.3	22.9
A 537 Cl. 1 (≤ 2½ in. thick)	A 691	1	CMSH70							
. . .	API 5L	SP-4	X56	(51) (55) (71)	−20	71	56	23.7	23.7	23.7
(> 3/8 in. thick)	A 381	SP-4	Y56	(51) (55) (71)	−20	71	56	23.7	23.7	23.7
. . .	API 5L	SP3	X52	(51) (55)	−20	72	52	24.0	24.0	24.0
(≤ 3/8 in. thick)	A 381	SP3	Y52	(51)	−20	72	52	24.0	24.0	24.0

TABLE A-1B
BASIC QUALITY FACTORS FOR LONGITUDINAL WELD JOINTS IN PIPES, TUBES, AND FITTINGS E_j

These quality factors are determined in accordance with para. 302.3.4(a). See also para. 302.3.4(b) and Table 302.3.4 for increased quality factors applicable in special cases. Specifications, except API, are ASTM.

Spec. No.	Class (or Type)	Description	E_j (2)	Appendix A Notes
Carbon Steel				
API 5L	. . .	Seamless pipe	1.00	. . .
	. . .	Electric resistance welded pipe	0.85	. . .
	. . .	Electric fusion welded pipe, double butt, straight or spiral seam	0.95	. . .
	. . .	Furnace butt welded	0.60	. . .
A 53	Type S	Seamless pipe	1.00	. . .
	Type E	Electric resistance welded pipe	0.85	. . .
	Type F	Furnace butt welded pipe	0.60	. . .
A 105	. . .	Forgings and fittings	1.00	(9)
A 106	. . .	Seamless pipe	1.00	. . .
A 120	. . .	Seamless pipe	1.00	. . .
	. . .	Electric resistance welded pipe	0.85	. . .
	. . .	Furnace butt welded pipe	0.60	. . .
A 134	. . .	Electric fusion welded pipe, single butt, straight or spiral seam	0.80	. . .
A 135	. . .	Electric resistance welded pipe	0.85	. . .
A 139	. . .	Electric fusion welded pipe, straight or spiral seam	0.80	. . .
A 179	. . .	Seamless tube	1.00	. . .
A 181	. . .	Forgings and fittings	1.00	(9)
A 211	. . .	Spiral welded pipe	0.75	. . .
A 234	. . .	Seamless and welded fittings	1.00	(16)
A 333	. . .	Seamless pipe	1.00	. . .
	. . .	Electric resistance welded pipe	0.85	. . .
A 334	. . .	Seamless tube	1.00	. . .
A 350	. . .	Forgings and fittings	1.00	(9)
A 369	. . .	Seamless pipe	1.00	. . .
A 381	. . .	Electric fusion welded pipe, 100% radiographed	1.00	(18)
	. . .	Electric fusion welded pipe, spot radiographed	0.90	(19)
	. . .	Electric fusion welded pipe, as manufactured	0.85	. . .
A 420	. . .	Welded fittings, 100% radiographed	1.00	(16)
A 524	. . .	Seamless pipe	1.00	. . .
A 587	. . .	Electric resistance welded pipe	0.85	. . .
A 671	12, 22	Electric fusion welded pipe, 100% radiographed	1.00	. . .
	13, 23	Electric fusion welded pipe, double butt seam	0.85	. . .
A 672	12, 22	Electric fusion welded pipe, 100% radiographed	1.00	. . .
	13, 23	Electric fusion welded pipe, double butt seam	0.85	. . .
A 691	12, 22	Electric fusion welded pipe, 100% radiographed	1.00	. . .
	13, 23	Electric fusion welded pipe, double butt seam	0.85	. . .

Flange Ratings—150 lb.

Table G-150 PN20 Pressure-Temperature Ratings
Gage pressures in bar

Mat'l Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	
Materials / Temp. °C	Carbon				C ½Mo	½Cr-½Mo Ni-Cr-Mo	1 1¼Cr-½Mo	2¼Cr-1Mo	5Cr-½Mo	9Cr-1Mo	Type 304	Type 316	Type 304L / Type 316L	Type 321	Types 347 348	Type 309	Type 310	Cr Fe Mo Cu Cb 20Cb	Nickel Alloy 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Nickel Alloys	Temperature °C
−29 to 38	19.6	20.0	18.4	16.3	18.4			20.0			19.0	19.0	15.9	19.0	19.0	17.8		15.8	9.5	15.9	19.0		20.0		38
50	19.2		18.1	16.0	18.3			19.2			18.4	18.4	15.3	18.4	18.5	17.4		15.6	9.5	15.4	18.7		19.5		50
100	17.7		17.3	14.8			17.7				15.7	16.2	13.2	15.9	16.7	15.9		14.6	9.5	13.8	17.3		17.7		100
150	15.8		15.8	14.5			15.8				13.9	14.8	12.0	14.4	15.5	15.0		13.8	9.5	12.9		15.8			150
200						14.0					12.6	13.7	11.0	13.2	14.0				9.5	12.6		14.0			200
250						12.1					11.7	12.1	10.2		12.1				9.5	11.9		12.1			250
300						10.2					10.2		9.7		10.2							10.2			300
350						8.4					8.4		8.4		8.4							8.4			350
375						7.4					7.4		7.4		7.4							7.4			375
400						6.5					6.5		6.5		6.5							6.5			400
425						5.6					5.6		5.6		5.6							5.6			425
450						4.7					4.7		4.7		4.7										450
475						3.7					3.7				3.7										475
500						2.8					2.8				2.8										500
525						1.9					1.9				1.9										525
540						1.3					1.3				1.3										540

= 256 PSI

NOTES:
1. Ratings shown apply to other material groups where column dividing lines have been omitted.
2. Provisions of Section 2 apply to all ratings.
3. See Temperature Notes for all Material Groups.

1 Bar = 14.5 p.s.i. (pressure)
°C = 0.5556 (°F−32) (temperature)

ANSI Pressure Temperature Ratings

ENGLISH UNITS

following pressure-temperature charts are derived from ANSI B16.34 - 1996 Version. It will cover the most commonly-used body and bonnet materials in the Industry. Pacific Valves are designed to operate through pressure and temperature range shown in these P-T Charts for a particular ANSI Class Rating and ASTM Material.

ASTM A216 GR. WCB

°F	STANDARD CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG						SPECIAL CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG					
	150	300	600	900	1500	2500	150	300	600	900	1500	2500
HYDROSTATIC SHELL TEST	450	1125	2225	3350	5575	9275	450	1125	2250	3375	5625	9375
HYDROSTATIC SEAT TEST	325	825	1650	2450	4100	6800	325	825	1650	2475	4125	6875
-20 TO 100	285	740	1480	2220	3705	6170	290	750	1500	2250	3750	6250
200	260	675	1350	2025	3375	5625	290	750	1500	2250	3750	6250
300	230	655	1315	1970	3280	5470	290	750	1500	2250	3750	6250
400	200	635	1270	1900	3170	5280	290	750	1500	2250	3750	6250
500	170	600	1200	1795	2995	4990	290	750	1500	2250	3750	6250
600	140	550	1095	1640	2735	4560	275	715	1425	2140	3565	5940
650	125	535	1075	1610	2685	4475	270	700	1400	2100	3495	5825
700	110	535	1065	1600	2665	4440	265	695	1390	2080	3470	5780
750	95	505	1010	1510	2520	4200	240	630	1260	1890	3150	5250
800	80	410	825	1235	2060	3430	200	515	1030	1545	2570	4285

NOTE: Upon prolonged exposure to temperatures above 800 F, the carbide phase of carbon steel may be converted to graphite. Permissible, but not recommended for prolonged usage above 800 F.

ASTM A216 GR. WCC

°F	STANDARD CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG								SPECIAL CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG							
	150	300	400	600	900	1500	2500	4500	150	300	400	600	900	1500	2500	4500
-20 TO 100	290	750	1000	1500	2250	3750	6250	11250	290	750	1000	1500	2250	3750	6250	11250
200	260	750	1000	1500	2250	3750	6250	11250	290	750	1000	1500	2250	3750	6250	11250
300	230	730	970	1455	2185	3640	6070	10925	290	750	1000	1500	2250	3750	6250	11250
400	200	705	940	1410	2115	3530	5880	10585	290	750	1000	1500	2250	3750	6250	11250
500	170	665	885	1330	1995	3325	5540	9965	290	750	1000	1500	2250	3750	6250	11250
600	140	605	805	1210	1815	3025	5040	9070	290	750	1000	1500	2250	3750	6250	11250
650	125	590	785	1175	1765	2940	4905	8825	290	750	1000	1500	2250	3750	6250	11250
700	110	570	755	1135	1705	2840	4730	8515	275	710	950	1425	2135	3560	5930	10670
750	95	505	670	1010	1510	2520	4200	7560	240	630	840	1260	1890	3150	5250	9450
800	80	410	550	825	1235	2060	3430	6170	195	515	685	1030	1545	2570	4285	7715
850	65	270	355	535	805	1340	2230	4010	130	335	445	670	1005	1670	2785	5015
900	50	170	230	345	515	860	1430	2750	80	215	285	430	645	1070	1785	3215
950	35	105	140	205	310	515	860	1545	50	130	170	260	385	645	1070	1930
1000	20	50	70	105	155	260	430	770	25	65	85	130	195	320	535	965

Note: Upon prolonged exposure to temperatures above 800 F, the carbide phase of carbon steel may be converted to graphite. Permissible, but not recommended for prolonged usage above 800 F.

ASTM A352 GR. LCB

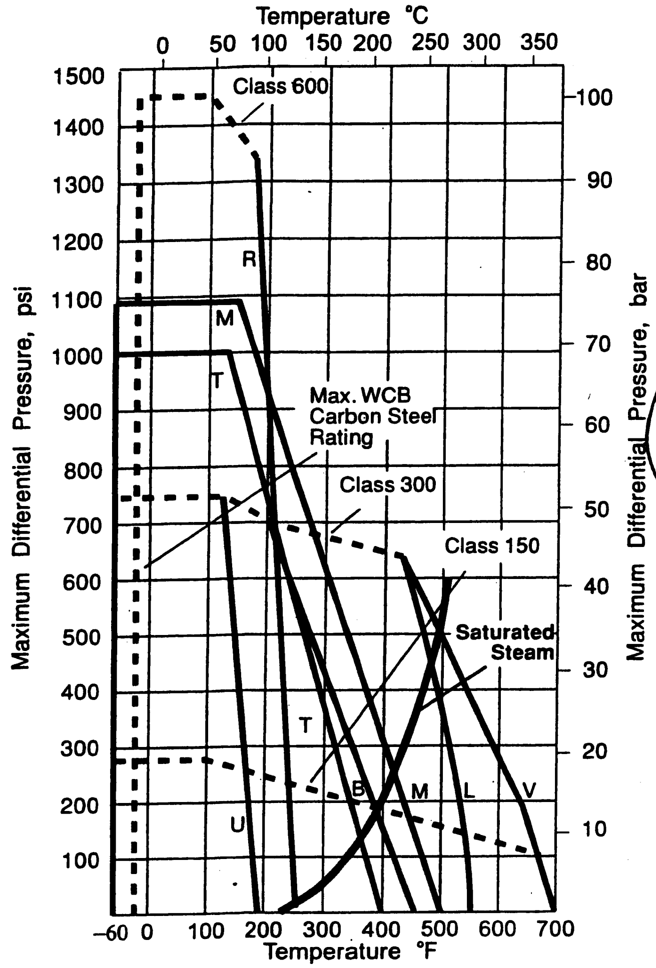
°F	STANDARD CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG						SPECIAL CLASS B16.34 - 1996 — MAXIMUM NON-SHOCK WORKING PRESSURE, PSIG					
	150	300	600	900	1500	2500	150	300	600	900	1500	2500
HYDROSTATIC SHELL TEST	400	1050	2100	3150	5225	8700	400	1050	2100	3150	5225	8700
HYDROSTATIC SEAT TEST	300	775	1550-	2300	3825	6375	300	775	1550	2100	3825	6375
-20 TO 100	265	695	1390	2085	3470	5785	265	695	1390	2085	3470	5785
200	250	655	1315	1970	3280	5470	265	695	1390	2085	3470	5785
300	230	640	1275	1915	3190	5315	265	695	1390	2085	3470	5785
400	200	620	1235	1850	3085	5145	265	695	1390	2085	3470	5785
500	170	585	1165	1745	2910	4850	265	695	1390	2085	3470	5785
600	140	535	1065	1600	2665	4440	265	695	1390	2085	3470	5780
650	125	525	1045	1570	2615	4355	260	680	1360	2040	3400	5670

Note: Not to be used over 650 F.

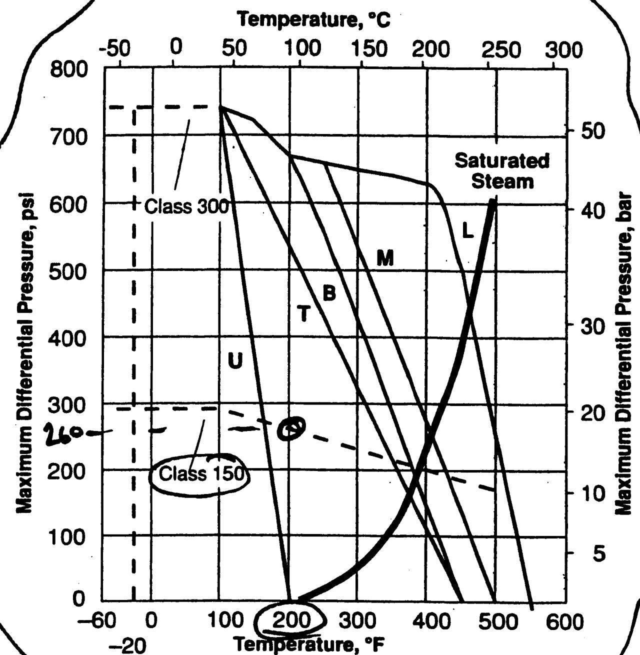
3201 Walnut Avenue Long Beach, CA 90807
Tel: 562.426.2531 • Fax: 562.595.9717 www.cranevalve.com

BALL VALVES

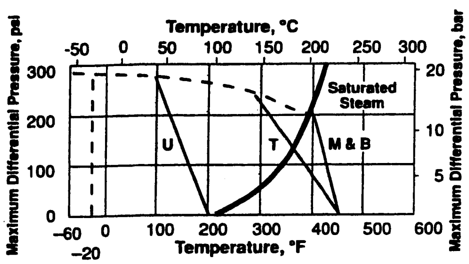
1/2" –2" Standard Bore
3/4" –1-1/2" Full Bore



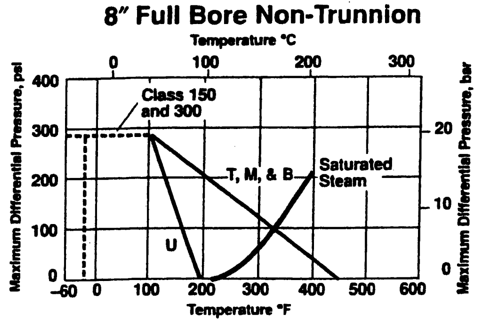
3" –6" Standard Bore
2" –4" Full Bore



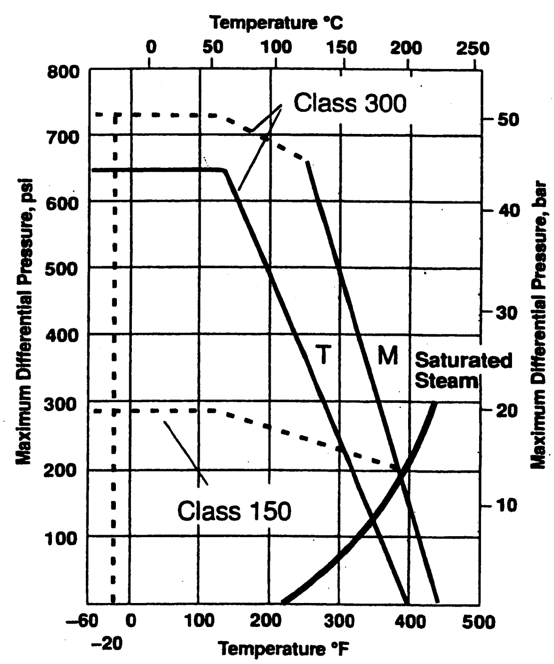
8" Standard Bore Non-Trunnion
6" Full Bore Non-Trunnion



10" Standard Bore Non-Trunnion
8" Full Bore Non-Trunnion



Trunnion Valves
8" –20" Standard Bore
6" –24" Full Bore



LEGEND: T = PTFE M = Filled PTFE B = PFA R = *Delrin*
L = PEEK V = Polymide U = UHMW
Delrin and *Vespel* are registered trademarks of DuPont

Valve Seat Ratings

Seat ratings, shown by the graph at right, are based on differential pressure with the *disc in the fully closed position* and refer to **seats only.** Maximum body working pressures are shown in the **Valve Body Ratings** tables below.

Valve Body Ratings

The tables below are maximum working pressure ratings of the **valve body only.** The seat ratings determine the practical pressure limitations according to actual service conditions. Test pressures are for hydostatic test with disc open.

Series 815, Class 150 Valve Body Ratings — psi					
Temp. °F	Carbon Steel*	Ductile Iron*	316 Stainless Steel*	Alloy 20*	Monel*
-20 to 100	285	250	275	230	280
200	260	235	240	215	200
300	230	215	215	200	190
400	200	200	195	—	185
500	170	170	170	—	170
Test Pressure	450	400	425	350	350

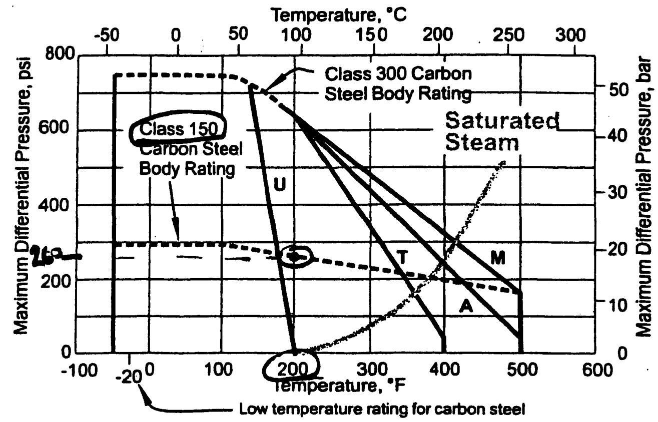
Series 815, Class 150 Valve Body Ratings — bar					
Temp. °C	Carbon Steel*	Ductile Iron*	316 Stainless Steel*	Alloy 20*	Monel*
-29 to 38	19.7	17.2	19.0	15.8	15.8
93	17.9	15.8	16.5	14.8	13.8
149	15.8	14.8	14.8	13.8	13.1
204	13.8	13.8	13.4	—	12.8
260	11.7	11.7	11.7	—	11.7
Test Pressure	31	27.6	29.3	24.1	24.1

Series 830, Class 300 Valve Body Ratings — psi				
Temp. °F	Carbon Steel*	316 Stainless Steel*	Alloy 20*	Monel*
-20 to 100	740	720	600	600
200	675	620	555	530
300	655	560	525	495
400	635	515	—	480
500	600	480	—	475
Test Pressure	1125	1100	900	900

Series 830, Class 300 Valve Body Ratings — bar				
Temp. °C	Carbon Steel*	316 Stainless Steel*	Alloy 20*	Monel*
-29 to 38	51	49.6	41.4	41.4
93	46.5	42.7	38.3	36.5
149	45.2	38.6	36.2	34.1
204	43.8	35.5	—	33.1
260	41.4	33.1	—	32.8
Test Pressure	77.6	75.8	62	62

* Ratings correspond to ASME/ANSI B16.34–1996 for material grades shown in bills of material herein. Ductile iron ratings conform to ASME/ANSI B16.42

Seat Ratings



T – PTFE M—FILLED PTFE SEAT A—*FIRE-TITE* U—UHMW Polyethylene

NOTE: 14"–60" Class 150 valves equipped with 316 stainless or Alloy 20 shafts are rated for maximum differential pressure of 150 psi.

3"–36" Class 300 valves equipped with 316 stainless or Alloy 20 shaft are rated for maximum differential pressure of 300 psi.

These ratings are a conservative guide for general service. Previous experience in a process or new developments and alternative seat materials may permit applications at ratings above those shown. Please consult Jamesbury Inc.'s ("Jamesbury's") home office for specific recommendations.

Flow Data

The tables below provide flow coefficients for Series 815 and 830 butterfly valves covered in this bulletin. The *Cv* values represent the number of gallons per minute of +60°F water that flows through a fully open valve at a pressure drop of 1 psi. Cv values for partially open valves are given on the top of the following page.

Series 815		
Valve Size		C_v
Inches	DN	
2-1/2	65	78
3	80	165
4	100	400
5	125	650
6	150	1,050
8	200	2,200
10	250	3,900
12	300	5,100
14	350	5,800
16	400	8,000
18	450	10,500
20	500	14,000
24	600	21,600
30	750	34,000
36	900	55,500
42	1050	82,650
48	1200	108,800
54	1350	133,500
60	1500	159,000

Series 830		
Valve Size		C_v
Inches	DN	
3	80	165
4	100	400
6	150	1,050
8	200	1,900
10	250	3,150
12	300	4,750
14	350	5,200
16	400	6,900
18	450	9,300
20	500	11,300
24	600	18,500
30	750	29,100
36	900	47,500

Worrall, Julian

From: Weston, Alan
Sent: Thursday, July 10, 2003 10:18 AM
To: Worrall, Julian; Schmidtke, Klaus
Subject: FW: 6883 Calculation of Sugar By-Products Injection parameters

The treatability study used 0.01% Sugar By-Products which is equivalent to 500 PPM
Requirement for field is a "Trace"
Therefore use 25 PPM to ensure no anaerobic conditions.

The southern injection system includes 9 wells at 100 foot spacing
For the record

Assume average depth of VCM plume is 50 feet
Assume porosity is 30%
Groundwater flow 0.4 feet/day

Plume cross section is 37,500 sq. feet
considering porosity cross section is 9,375 sq. feet
flow per day is 3,750 cubic feet/day or 106,169 Liters per day
Sugar By-Products at 25 mg/L requires 2.65 Kg or 6 pounds per day

Inject 100 gallons/day/well i.e. total 900 gallons dissolve 6 pounds Sugar By-Products in 900 gallons or 1 pound in 150 gallons.
Recommend injection of 100 gallons at 1 gallon per minute in each well.

Alan F. Weston, Ph.D.
Director of Remedial Technology,
Conestoga Rovers and Associates,
2055 Niagara Falls Blvd., Suite 3,
Niagara Falls, NY 14304
phone: (716) 297-6150 fax: (716) 297-2265
email: aweston@craworld.com

Hicksville Biosparge Project
Electrical Service Sizing

Item	Description	HP or kVA	A	
1	Air Compressor	100	137	(225A)
2	Air Compressor	100	137	
3	Suppl. Tank Mixer	1.5	3	
4	Suppl. Injection Pump	1.5	3	
5	15kVA xfmr (70% load)	10	12	
6	45kVA xfmr (60% load)	27	32	
7				
		Total:	324.00	

Service MCB: 225A+137A+3A+3A+12A+32A= 412A Select 400A @480VAC

6883.00
bme
10/12/03

Hicksville Biosparge Project
Injection Well Feeder Sizes

Well #	L, ft	R, ohm	Wire, awg
		Load: 7.2A @ 277V	
IW-1	1100	0.87	[redacted]
IW-2	1000	0.96	[redacted]
IW-3	900	1.07	[redacted]
IW-4	750	1.28	[redacted]
IW-5	650	1.48	[redacted]
IW-6	550	1.75	[redacted]
IW-7	550	1.75	[redacted]
IW-8	650	1.48	[redacted]
IW-9	775	1.24	[redacted]
IW-10	875	1.10	[redacted]
IW-11	975	0.99	[redacted]
IW-12	1100	0.87	[redacted]
IW-13	900	1.07	[redacted]
IW-14	800	1.20	[redacted]
IW-15	700	1.37	[redacted]
IW-16	600	1.60	[redacted]
IW-17	550	1.75	[redacted]
IW-18	650	1.48	[redacted]
IW-19	750	1.28	[redacted]
IW-20	850	1.13	[redacted]
IW-21	950	1.01	[redacted]
IW-22	1050	0.92	[redacted]

6883.00
bme
9/30/03

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

The HVAC equipment for the Treatment Building will consist of two independent systems. The Control Room will have a unitary, through-the-wall combination heating and air conditioning unit. The Equipment Room will have an intake louver and exhaust fan to provide outside dilution air ventilation.

The heating and cooling loads for the Control Room consist primarily of conductive gains and losses through the building envelope resulting from climatic conditions. There are also minor internal heat gains from lighting and electrical equipment that are not significant loads. Sizing of the unitary heating and air conditioning unit is based on a thermostatic set point of 75°F and ASHRAE 1% climatic design criteria. For Hicksville, New York these values are 12°F winter dry bulb, 92°F summer dry bulb, and 73°F summer wet bulb ambient temperatures.

The Control Room air conditioner will be sized for 12,000 BTU's per hour cooling and 10,600 Btu's per hour heating capacity.

The HVAC design criteria for the Equipment Room is freeze protection in the winter, and heat dissipation in the summer. Precision temperature control is not intended.

The variable speed air compressor has a power converter that dissipates heat whenever the compressor is in operation. The level of heat dissipation is sufficient to keep the Equipment Room above freezing temperatures. The room will also be equipped with two electric resistance unit heaters that will provide freeze protection when the compressor is not in operation for extended periods of time.

During summer months, the Equipment Room will experience conductive heat gains through the building envelope as well as heat dissipation from the compressor power converter. This heat gain will be dissipated using outside air for dilution ventilation. The Equipment Room will have an intake air louver and wall exhaust fan to provide adequate fresh air turnover under these conditions. The dilution air equipment will be sized for 2,000 CFM, large enough to provide a 4 minute air change and a maximum inside temperature gradient of 10°F.

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1400 COOLING OA DB / WB 91.6 °F / 73.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 13.0 °F / 10.4 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	760 ft²	1904	-	760 ft²	2830	-
Roof Transmission	312 ft²	1006	-	312 ft²	832	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	312 ft²	0	-	312 ft²	742	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	505 W	1724	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	500 W	1706	-	0	0	-
People	2	490	410	0	0	0
Infiltration	-	272	205	-	935	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	710	62	10%	534	0
>> Total Zone Loads	**-**	**7811**	**677**	**-**	**5872**	**0**
Zone Conditioning	-	7476	677	-	5754	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	426 CFM	0	-	426 CFM	0	-
Ventilation Load	30 CFM	464	405	30 CFM	1814	0
Supply Fan Load	426 CFM	0	-	426 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**7940**	**1081**	**-**	**7568**	**0**
Central Cooling Coil	-	7940	1082	-	0	0
Central Heating Coil	-	0	-	-	7568	-
>> Total Conditioning	**-**	**7940**	**1082**	**-**	**7568**	**0**
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Design Parameters:

City Name	New York La Guardia	
Location	New York	
Latitude	40.8	Deg.
Longitude	73.9	Deg.
Elevation	30.0	ft
Summer Design Dry-Bulb	92.0	°F
Summer Coincident Wet-Bulb	74.0	°F
Summer Daily Range	14.6	°F
Winter Design Dry-Bulb	13.0	°F
Winter Design Wet-Bulb	10.4	°F
Atmospheric Clearness Number	1.00	
Average Ground Reflectance	0.20	
Soil Conductivity	0.800	BTU/(hr-ft-°F)
Local Time Zone (GMT +/- N hours)	5.0	hours
Consider Daylight Savings Time	No	
Simulation Weather Data	noneN/A	
Current Data is	2001 ASHRAE Handbook	
Design Cooling Months	January to December	

Design Day Maximum Solar Heat Gains

(The MSHG values are expressed in BTU/(hr-ft²))

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	19.0	19.0	19.0	80.4	145.5	206.1	236.0	250.8	252.6
February	23.5	23.5	45.4	126.5	189.3	229.4	249.0	246.9	241.2
March	28.4	28.4	100.8	163.2	215.6	239.7	237.1	219.5	207.0
April	33.4	71.1	137.1	193.8	220.9	224.9	201.5	172.8	156.1
May	36.8	103.7	159.8	204.5	220.7	206.8	175.1	134.4	115.4
June	44.7	115.0	166.8	206.7	216.7	198.2	161.4	118.2	97.9
July	37.7	102.4	159.2	202.0	214.7	203.7	169.5	131.7	111.4
August	35.0	68.5	135.0	187.0	210.8	217.5	195.6	167.4	150.4
September	29.6	29.6	92.3	157.1	201.0	228.9	225.9	211.3	201.6
October	24.4	24.4	49.9	116.3	181.0	223.0	240.0	238.5	234.8
November	19.4	19.4	19.4	76.7	146.9	198.4	235.2	248.4	249.7
December	17.0	17.0	17.0	61.9	126.2	190.7	225.4	246.9	250.4

Month	SSW	SW	WSW	W	WNW	NW	NNW	HOR	Mult
January	252.3	237.9	204.6	146.4	80.6	19.0	19.0	126.9	1.00
February	247.1	249.6	230.4	190.1	118.8	52.5	23.5	174.9	1.00
March	219.2	236.3	240.3	213.8	166.0	100.1	28.4	217.6	1.00
April	173.6	203.3	225.6	218.5	193.3	139.8	67.7	247.9	1.00
May	135.9	174.6	208.8	218.1	205.7	162.4	101.8	262.5	1.00
June	118.8	160.6	198.9	216.0	207.3	167.8	114.5	264.8	1.00
July	131.4	169.8	203.3	215.3	201.8	158.3	102.9	258.9	1.00
August	167.6	196.1	217.6	210.6	186.7	135.7	67.3	243.1	1.00
September	212.0	227.8	225.3	205.6	154.4	92.4	29.6	211.3	1.00
October	237.6	237.6	223.2	176.4	122.1	44.3	24.4	172.7	1.00
November	246.1	234.4	201.3	146.5	74.7	19.4	19.4	127.4	1.00
December	245.0	228.1	190.0	130.1	59.0	17.0	17.0	106.4	1.00

Mult. = User-defined solar multiplier factor.

TABLE 1.1.A. COMPONENT LOADS FOR SPACE " Control Room " IN ZONE " Zone 1 "

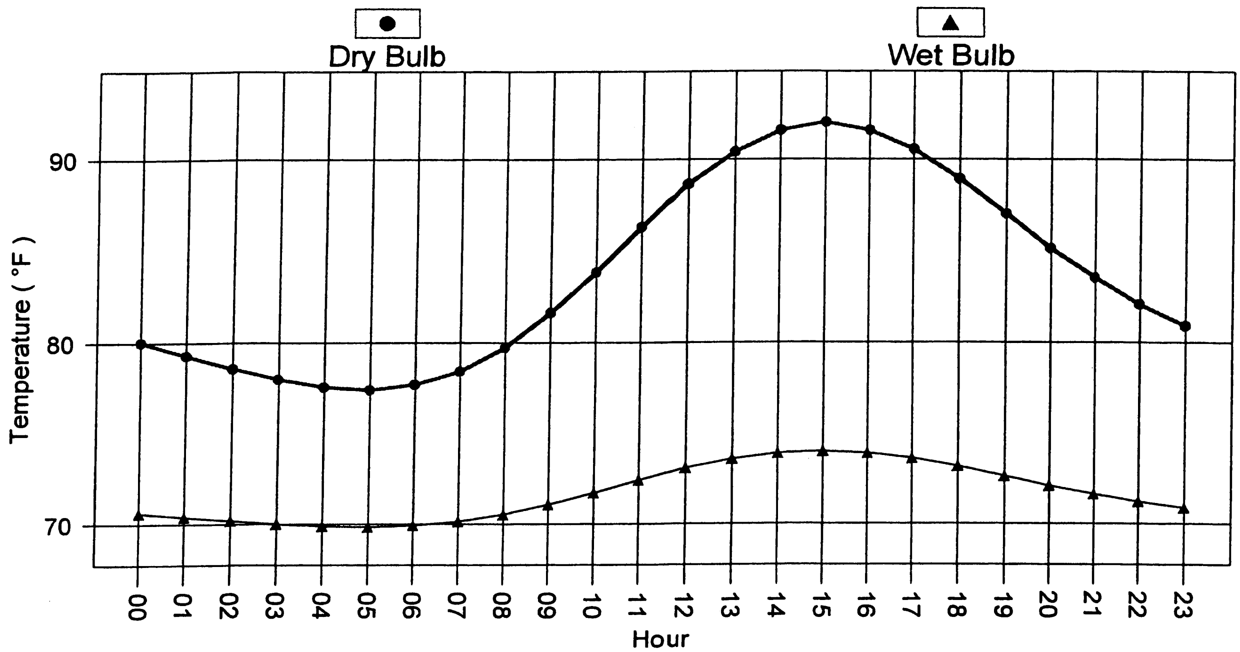
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1400 COOLING OA DB / WB 91.6 °F / 73.9 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 13.0 °F / 10.4 °F OCCUPIED T-STAT 70.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	760 ft²	1904	-	760 ft²	2830	-
Roof Transmission	312 ft²	1006	-	312 ft²	832	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	312 ft²	0	-	312 ft²	742	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	505 W	1724	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	500 W	1706	-	0	0	-
People	2	490	410	0	0	0
Infiltration	-	272	205	-	935	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	710	62	10%	534	0
>> Total Zone Loads	-	7811	677	-	5872	0

TABLE 1.1.B. ENVELOPE LOADS FOR SPACE " Control Room " IN ZONE " Zone 1 "

	Area (ft²)	U-Value (BTU/(hr-ft²-°F))	Shade Coeff.	COOLING TRANS (BTU/hr)	COOLING SOLAR (BTU/hr)	HEATING TRANS (BTU/hr)
N EXPOSURE						
WALL	260	0.065	-	393	-	968
E EXPOSURE						
WALL	120	0.065	-	222	-	447
W EXPOSURE						
WALL	120	0.065	-	405	-	447
S EXPOSURE						
WALL	260	0.065	-	883	-	968
H EXPOSURE						
ROOF	312	0.047	-	1006	-	832

Location: New York La Guardia, New York

Design Temperature Profiles for August



August DESIGN COOLING DAY, 1400

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	91.6	0.01391	30	464	405
Vent - Return Mixing	Outlet	78.2	0.01127	426	-	-
Central Cooling Coil	Outlet	61.0	0.01073	426	7940	1082
Central Heating Coil	Outlet	61.0	0.01073	426	0	-
Supply Fan	Outlet	61.0	0.01073	426	0	-
Cold Supply Duct	Outlet	61.0	0.01073	426	0	-
Zone Air	-	77.2	0.01107	426	7476	677
Return Plenum	Outlet	77.2	0.01107	426	0	-
Return Fan	Outlet	77.2	0.01107	426	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.079 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4741.5 BTU/(hr-CFM)
Site Altitude = 30.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	7811	Cooling	7476	77.2	426	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	13.0	0.00077	30	-1814	0
Vent - Return Mixing	Outlet	65.1	0.00077	426	-	-
Central Cooling Coil	Outlet	65.1	0.00077	426	0	0
Central Heating Coil	Outlet	81.6	0.00077	426	7568	-
Supply Fan	Outlet	81.6	0.00077	426	0	-
Cold Supply Duct	Outlet	81.6	0.00077	426	0	-
Zone Air	-	69.1	0.00077	426	-5754	0
Return Plenum	Outlet	69.1	0.00077	426	0	-
Return Fan	Outlet	69.1	0.00077	426	0	-

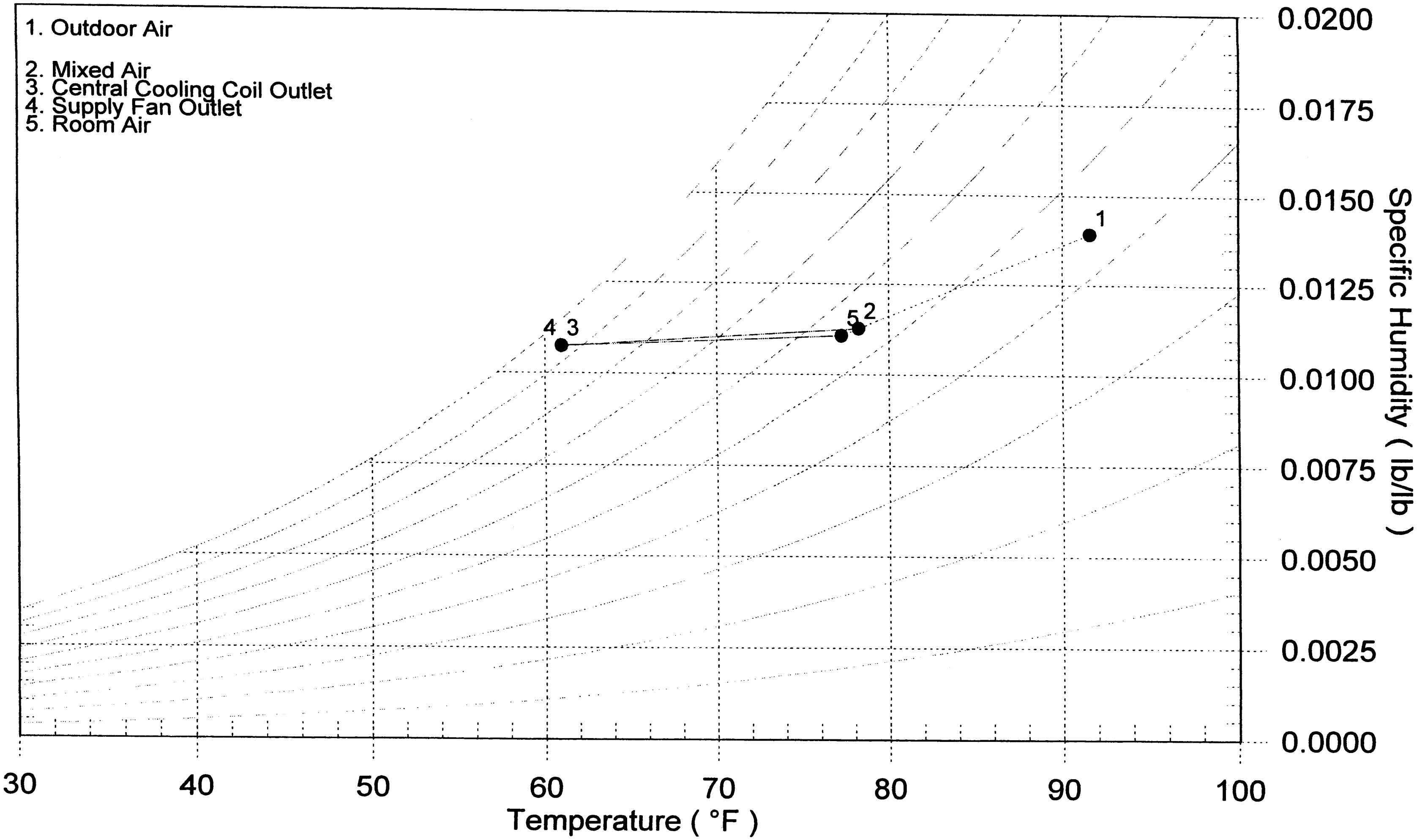
Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.079 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4741.5 BTU/(hr-CFM)
Site Altitude = 30.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	-5872	Heating	-5754	69.1	426	0	0

Psychrometric Ar   sis for Default System

Location: New York La Guardia, New York
Altitude: 30.0 ft.
Data for: August DESIGN COOLING DAY, 1400



Control Room

General Details:
Floor Area .... **312.0** ft²
Avg. Ceiling Height .... **10.0** ft²
Building Weight .... **90.0** lb/ft²

2. Internals:

2.1. Overhead Lighting:
Fixture Type .... **Recessed (Unvented)**
Wattage .... **1.50** W/ft²
Ballast Multiplier **1.08**
Schedule .... **HVAC Schedule**

2.2. Task Lighting:
Wattage .... **0.00** W/ft²
Schedule .... **None**

2.3. Electrical Equipment:
Wattage .... **500.0** Watts
Schedule .... **HVAC Schedule**

2.4. People:
Occupancy .... **2** People
Activity Level .... **Office Work**
Sensible .... **245.0** BTU/hr/person
Latent .... **205.0** BTU/hr/person
Schedule .... **HVAC Schedule**

2.5. Miscellaneous Loads:
Sensible .... **0** BTU/hr
Schedule .... **None**
Latent .... **0** BTU/hr
Schedule .... **None**

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	260.0	0	0	0
E	120.0	0	0	0
W	120.0	0	0	0
S	260.0	0	0	0

.1. Construction Types for Exposure N
Wall Type .... **Control Room Wall Assembly**

3.2. Construction Types for Exposure E
Wall Type .... **Control Room Wall Assembly**

3.3. Construction Types for Exposure W
Wall Type .... **Control Room Wall Assembly**

3.4. Construction Types for Exposure S
Wall Type .... **Control Room Wall Assembly**

4. Roofs, Skylights:

Exp.	Roof Gross Area (ft²)	Roof Slope (deg.)	Skylight Qty.
H	312.0	0	0

4.1. Construction Types for Exposure H
Roof Type .... **Default Roof Assembly**

5. Infiltration:
Design Cooling .... **0.02** CFM/ft²
Design Heating .... **0.02** CFM/ft²
Energy Analysis .... **0.02** CFM/ft²
Infiltration occurs at all hours.

6. Floors:
Type .... **Slab Floor On Grade**
Floor Area .... **312.0** ft²
Total Floor U-Value .... **0.100** BTU/(hr-ft²-°F)
Exposed Perimeter .... **76.0** ft
Edge Insulation R-Value .... **5.00** (hr-ft²-°F)/BTU

. Partitions:
(No partition data).

1. General Details:

Air System Name .... Default System
Equipment Class .... Undefined
Air System Type .... Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control .... Constant Ventilation Airflow
Design Airflow .... 15.00 CFM/person
Unocc. Damper Position .... Closed
Damper Leak Rate .... 0 %

Central Cooling Data:

Supply Air Temperature .... 58.0 °F
Coil Bypass Factor 0.100
Cooling Source .... Any
Schedule .... JFMAMJJASOND
Capacity Control .... Cycled or Staged Compressor - Fan On

Central Heating Data:

Supply Temperature .... 110.0 °F
Heating Source .... Any
Schedule .... JFMAMJJASOND
Capacity Control .... Cycled or Staged Compressor - Fan On

Supply Fan Data:

Fan Type .... Forward Curved
Configuration .... Draw-thru
Fan Performance .... 0.00 in wg
Overall Efficiency .... 54 %

Duct System Data:

Supply Duct Data:

Duct Heat Gain .... 0 %
Duct Leakage .... 0 %

Return Duct or Plenum Data:

Return Air Via .... Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
Control Room	x1

Thermostats and Zone Data:

Zone .... All
Cooling T-stat: Occ. .... 75.0 °F
Cooling T-stat: Unocc. .... 85.0 °F
Heating T-stat: Occ. .... 70.0 °F
Heating T-stat: Unocc. .... 60.0 °F
T-stat Throttling Range .... 3.00 °F
Diversity Factor .... 100 %
Direct Exhaust Airflow .... 0.0 CFM
Direct Exhaust Fan kW .... 0.0 kW

Thermostat Schedule .... Bill Schedule
Unoccupied Cooling is .... Available

Supply Terminals Data:

Zone .... All
Terminal Type .... Diffuser
Minimum Airflow .... 0.00 CFM/person

Zone Heating Units:

Zone .... All
Zone Heating Unit Type .... None

Zone Unit Heat Source .... Any
Zone Heating Unit Schedule .... JFMAMJJASOND

4. Sizing Data (Computer-Generated):
System Sizing Data:
Hydronic Sizing Specifications:

Chilled Water Delta-T	**10.0**	°F
Hot Water Delta-T	**20.0**	°F

Safety Factors:

Cooling Sensible	**10**	%
Cooling Latent	**10**	%
Heating	**10**	%

Zone Sizing Data:

Zone Airflow Sizing Method	**Sum of space airflow rates**
Space Airflow Sizing Method	**Individual peak space loads**

5. Equipment Data
No Equipment Data required for this system.

Air System Sizing Summary for Default System

Project Name: Hicksville Biosparge Treatment Building — 10/31/2003
Prepared by: Conestoga-Rovers & Associates — 01:56PM

Air System Information

Air System Name	Default System		Number of zones	1	
Equipment Class	UNDEF		Floor Area	312.0	ft²
Air System Type	SZCAV				

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Sum of space airflow rates	Calculation Months	Jan to Dec
Space CFM	Individual peak space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	0.8	Tons	Load occurs at	Aug 1400	
Total coil load	9.0	MBH	OA DB / WB	91.6 / 73.9	°F
Sensible coil load	7.9	MBH	Entering DB / WB	78.2 / 66.6	°F
Coil CFM at Aug 1400	426	CFM	Leaving DB / WB	61.0 / 59.9	°F
Max block CFM	426	CFM	Coil ADP	59.0	°F
Sum of peak zone CFM	426	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.880		Resulting RH	55	%
ft²/Ton	415.0		Design supply temp.	58.0	°F
BTU/(hr-ft²)	28.9		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	1.81	gpm	Max zone temperature deviation	0.0	°F

Central Heating Coil Sizing Data

Max coil load	7.6	MBH	Load occurs at	Des Htg	
Coil CFM at Des Htg	426	CFM	BTU/(hr-ft²)	24.3	
Max coil CFM	426	CFM	Ent. DB / Lvg DB	65.1 / 81.6	°F
Water flow @ 20.0 °F drop	0.76	gpm			

Supply Fan Sizing Data

Actual max CFM	426	CFM	Fan motor BHP	0.00	BHP
Standard CFM	425	CFM	Fan motor kW	0.00	kW
Actual max CFM/ft²	1.37	CFM/ft²	Fan static	0.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	30	CFM	CFM/person	15.00	CFM/person
CFM/ft²	0.10	CFM/ft²			

Zone Sizing Summary for Default System

Project Name: Hicksville Biosparge Treatment Building
Prepared by: Conestoga-Rovers & Associates

10/31/2003
01:56PM

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM .... **Sum of space airflow rates**
Space CFM .... **Individual peak space loads**

Calculation Months .... **Jan to Dec**
Sizing Data .... **Calculated**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	7.8	426	426	Aug 1400	5.9	312.0	1.37

Zone Terminal Sizing Data

No Zone Terminal Sizing Data required for this system.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Control Room	1	7.8	Aug 1400	426	5.9	312.0	1.37