Sam's Liquor Locker
Bid #: D1486
Client: Bud Atkins
Date Prepared: 9/09/2007

WIRE SIZING CALCULATION
2011/2014 NEC Article 310

Full Load Amperage ..... : 34
Source Voltage ..... : 480
Length of Run (Feet) ..... : 100
Load Duty ..... : Continuous

Conductor Application ..... : Conductors in Raceway, Cable or Earth
Conductor Ampacity Table ..... : NEC Table 310-15(B)(16)
Conductor Type ..... : THHN Copper
Conductor Location ..... : Dry/Damp
Conductor Insulation Temperature : 90 °C

Ambient Temperature ..... : 26-30 °C = 78-86 °F

Terminal Temperature Rating .... : 75 °C

Circuit Type : Three Phase 3 Wire (3 phase conductors)

Qty. of Circuit Current-Carrying Conductors : 3
Additional Current-Carrying Conductors ..... : 4

Total Qty. Current-Carrying Conductors ..... : 7

Conductor Requirement:
Full Load Amps ..... : 34.0
Load Duty Multiplier ..... : 1.25
Ambient Temp. Multiplier . : 1.0
Qty. Conductors Multiplier : 1.43

Required Conductor Ampacity: 60.71

Terminal Requirement:
Full Load Amps ..... : 34.0
Load Duty Multiplier ..... : 1.25

Required Terminal Ampacity : 42.5

Selected Conductor:
Conductor Ampacity ..... : 75.0
Ambient Temp. Derate ..... : 1.0
Qty. Conductors Derate ... : 0.7

Adjusted Ampacity ..... : 52.5

SELECTED CONDUCTOR SIZE : 6 Awg

$$VD = \frac{0.866 \times 2 \times \text{Ohms/MilFt} \times \text{Length} \times \text{Amps}}{1000 \times \text{Qty Wires per Phase}} = \frac{0.866 \times 2 \times 0.491 \times 100 \times 60.71}{1000 \times 1} = 2.89$$

Volts At Load Terminals..... : 477.11
Actual Percent Voltage Drop . : 0.6

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VOLTAGE DROP CALCULATION

Voltage ..... : 208

Load Amperage ..... : 16

Circuit Length (Ft) .. : 75

Conductor Size ..... : 10 Awg

Conductors Per Phase . : 1

Conductor Material ... : Copper

Circuit Type .. : AC Single Phase 2 Wire

Voltage Drop between neutral and phase conductor

$$VD = \frac{(2 \times \text{Ohms per 1000 ft} \times \text{Length} \times \text{Amps})}{1000 \times \text{Qty Wires per Phase}}$$

$$VD = \frac{2 \times 1.24 \times 75 \times 16}{1000 \times 1}$$

Volts Dropped : 2.98

Volts At Load : 205.02

Percent Drop .: 1.43

TRANSFORMER
NEC Article 450

Transformer Rating (Kva) ... : 75
Primary Voltage ..... : 480
Secondary Voltage ..... : 208
Percent Impedance ..... : 2
Phase ..... : Three

Overcurrent Protection ..... : Primary and Secondary Protection

Primary Overcurrent Type ..... : Circuit Breaker
Secondary Overcurrent Type ... : Circuit Breaker
Transformer Type ..... : Distribution Transformer

Minimum Transformer Kva ..... : 75

Transformer Rated Primary Amperage ..... : 90.32
Transformer Rated Secondary Amperage ..... : 208.43

Max. Primary Feeder Amps ..... : 225.79
Next Standard Size Allowed ..... : n/a

Maximum Secondary Overcurrent Protection Amperage . : 260.53
Next Standard Size Allowed ..... : 300

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POWER FACTOR CALCULATION

Phase of Load ..... : Three Phase
Measured Line Voltage ..... : 201
Measured Line Current (Amp) : 30
Measured True Power (Kw) .. : 8.5

	Existing	Proposed
Power Factor (%)	81.48	95.0
Phase Angle (Deg)	35.4	18.15
KiloVoltAmps (Kva)	10.43	8.95
Line Current (Amp)	30.0	25.73
Kva Reactive (Kva)	6.04	2.79

Distribution System Losses Recovered At Proposed PF (Kva): 1.48

Capacitive Kvars Required For Proposed PF: 3.26

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Main Service Panel
Fed From: Utility Overhead Drop
Volts: 120/208 Amps: 200 Phase: 3
Panel Short Circuit Amps Rating: 26500

1	Oven	50	40	A/C Condenser	2
3					4
5	Bathroom GFCI	20	15	Basement Lights	6
7	Kitchen Counter GFCI	20	20	Kitchen Refrigerator	8
9	Dining Room Lights	15	20	Dining Room Outlets	10
11	Master BR Lights	15	20	Master BR Outlets	12
13	Hall Lights, Outlets	15	20	Garage Door Opener	14
15	Attic Fan	20	20	Garbage Disposal	16
17	Dishwasher	20	40	Jenn-air Cooktop	18
19	Water Heater	30			20
21			15	Guest BR Lights	22
23	Furnace	20	20	Exhaust Fan	24
25					26
27	Exhaust Hood #1	20	30	Exhaust Hood #2	28
29					30
31					32
33					34
35					36
37					38
39					40
41					42
43					44
45					46
47					48
49					50
51					52
53					54
55					56
57					58
59					60
61					62
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69					70
71					72
73					74
75					76
77					78
79					80
81					82
83					84

TriPhase Electric Inc
123 Main Street
Washington NJ 07812
Phone: 973-123-4567

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MOTOR CALCULATION
2011/2014 NEC Article 430

Motor Type ..... : 3 Phase - Wound Rotor
Motor Voltage ..... : 480
Motor Horsepower ..... : 25

Nameplate FLA ..... : 21.0
Service Factor ..... : 1.15
Temperature Rise (Deg.C) : 40.0

Overcurrent Type ..... : Instantaneous Trip Breaker

Conductor Application ..... : Conductors in Raceway, Cable or Earth
Conductor Ampacity Table ..... : NEC Table 310-15(B)(16)
Conductor Type ..... : XHHW-2 Alumin
Conductor Location ..... : Dry/Wet
Conductor Insulation Temperature : 90 °C

Ambient Temperature ..... : 26-30 °C = 78-86 °F

Terminal Temperature Rating .... : 75 °C

Circuit Type : Three Phase 3 Wire (3 phase conductors)

Qty. of Circuit Current-Carrying Conductors : 3

Conductor Requirement
NEC Table FLA ..... : 34.0
125% Multiplier ..... : 1.25
Ambient Temp. Multiplier . : 1.0
Qty. Conductors Multiplier : 1.0 [Current Carrying Conductors/Raceway: 3]

Required Conductor Ampacity: 42.5

Terminal Requirement:
Full Load Amps ..... : 34.0
125& Multiplier ..... : 1.25

Required Terminal Ampacity : 42.5

Selected Conductor:
Conductor Ampacity ..... : 50.0
Ambient Temp. Derate ..... : 1.0
Qty. Conductors Derate ... : 1.0

Adjusted Ampacity ..... : 50.0

SELECTED CONDUCTOR: 6 Awg

OVERLOAD RATING: 21.0 Amps x 1.25: 26.25 Amp

OVERCURRENT RATING
Calculated: 272.0 Amp Standard .: 300 Amp

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LIGHTING DESIGN
Zonal Cavity Method

Room Length .....: 50
Room Width .....: 50
Square Footage .....: 2500.0

Ceiling Height .....: 12
Fixture Height .....: 10
Work Height .....: 3

Ceiling Cavity Ratio .....: 0.4
Ceiling Reflectance % .....: 80
Ceiling Effective Reflectance %: 75.0

Room Cavity Ratio .....: 1.4
Wall Reflectance % .....: 60

Floor Cavity Ratio .....: 0.6
Floor Reflectance % .....: 40
Floor Effective Reflectance % .: 38.0

Maintenance Factor .....: 0.8

Fixture Type .....: 2 Lamp F48 Surface
Fixture CU .....: 0.77

Lamp Type .....: F48/T12/CW*
Lumens/Lamp .....: 2800
Lamps/Fixture ....: 2
Lumens Per Fixture: 5600

Quantity of Fixtures Selected: 36

Initial Installed Footcandles: 62.5

Maintained Footcandles: 50.0

FAULT CURRENT CALCULATION

Point #1 Description: Point 1

Calculation Type: Fault at End of a Run of Conductors

Fault Current Available At Source ... : 12879
One Way Conductor Length (Ft) ..... : 25
Quantity Parallel Conductors Per Phase: 1
Conductor Size ..... : 6 Awg
Line To Line Voltage At This Point .. : 480
Phase ..... : 3
Conductor/Raceway: Copper conductors / Steel Raceway

POINT #	SOURCE S.C. AMPS	C	FACTORS F	M	SHORT CIRCUIT AMPS AT FAULT
1	12879	2222	0.5222554	0.65692	8460

Formulas Used In This Calculation:

C Factor = 1 / Z Per Ft = 1 / .00045 = 2222

$$\text{F Factor} = \frac{1.73 \times L \times I}{PC \times C \times E} = \frac{1.73 \times 25 \times 12879}{1 \times 2222 \times 480} = .5222554$$

$$\text{M Factor} = \frac{1}{1 + \text{F Factor}} = \frac{1}{1 + .5222554} = .65692$$

Short Circuit Amps At Fault = I x M = 12879 x .65692 = 8460

Legend:
C = C factor
E = Line to line voltage
I = Fault current available at source
L = Conductor length in feet
PC = Quantity parallel conductors per phase
Z Per Foot = Conductor impedance per foot

FAULT CURRENT CALCULATION

Point #2 Description: Point 2

Calculation Type: Fault at Secondary Terminals of a Transformer

Fault Current Available At Primary: 8460
Transformer Kva ..... : 300 %Z: 4
Transformer Primary Voltage ..... : 480 Secondary Voltage: 208
Phase ..... : 3

POINT #	SOURCE S.C. AMPS	FACTORS F	FACTORS M	SHORT CIRCUIT AMPS AT FAULT
2	8460	0.9377741	0.5160561	10075

Formulas Used In This Calculation:

$$\text{F Factor} = \frac{1.73 \times Ep \times I \times \%Z}{100{,}000 \times Kva} = \frac{1.73 \times 480 \times 8460 \times 4}{100{,}000 \times 300} = .9377741$$

$$\text{M Factor} = \frac{1}{1 + \text{F Factor}} = \frac{1}{1 + .9377741} = .5160561$$

$$\text{Fault Current Amps} = \frac{Ep}{Es} \times \text{M factor} \times I = \frac{480}{208} \times .5160561 \times 8460 = 10075$$

Legend:
Ep = Voltage at transformer primary
Es = Voltage at transformer secondary
I = Fault current available at transformer primary
Kva = KiloVoltAmps of transformer
%Z = Transformer impedence

FAULT CURRENT CALCULATION

Point #3 Description: Point 3

Calculation Type: Fault Downstream of Secondary of a Transformer

Fault Current Available At Source ... : 10075
Transformer Kva ..... : 300 %Z: 4
Transformer Primary Voltage ..... : 480
One Way Conductor Length (Ft) ..... : 33
Quantity Parallel Conductors Per Phase: 2
Conductor Size ..... : 1/0 Awg
Phase ..... : 3
Conductor/Raceway: Copper conductors / Steel Raceway

POINT #	SOURCE S.C. AMPS	FACTORS C	F	M	SHORT CIRCUIT AMPS AT FAULT
3	10075	7692	0.0779792	0.9276617	8369

Formulas Used In This Calculation:

C Factor = 1 / Z Per Ft = 1 / .00013 = 7692.308

$$\text{Transformer FLA} = \frac{\text{KVA} \times 1000}{\text{E} \times 1.732} = \frac{300 \times 1000}{480 \times 1.732} = 360.8545$$

$$\text{Transformer Multiplier} = \frac{100}{\%Z} = \frac{100}{4} = 25$$

Isct = FLA x Transformer Multiplier = 360.8545 x 25 = 9021.362

$$\text{F Factor} = \frac{1.73 \times L \times I}{PC \times C \times E} = \frac{1.73 \times 33 \times 10075}{2 \times 7692.308 \times 480} = .0779792$$

$$\text{M Factor} = \frac{1}{1 + \text{F Factor}} = \frac{1}{1 + .07797924} = .9276617$$

Short Circuit Amps At Fault = I x M = 10075 x .9276617 = 8369

Legend:
C = C factor
E = Line to line voltage
I = Fault current available at source
Isct = Transformer let-through short circuit current, in amps
Kva = KiloVoltAmps of transformer
PC = Quantity parallel conductors per phase
%Z = Transformer impedence
Z Per Ft = Conductor impedence per foot

CONDUIT FILL CALCULATION
NEC Chapter 9 Tables

QTY	SIZE	CONDUCTOR TYPE	AREA PER Sq. In	TOTAL AREA Sq. In
6	14	THHN	0.0097	0.0582
12	12	THHN	0.0133	0.1596
3	10	RHH	0.0437	0.1311
6	8	THW	0.0556	0.3336
1	8	Bare	0.017	0.017

Total Conductor Area (Sq. In.): 0.6995

Raceway Type: EMT Electrical Metallic Tubing

SELECTED SIZE: 1 1/2 Inch

Ttl. Conduit Cross Section (Sq. In.) : 2.036
Maximum Allowable Fill Percent : 40.0

Max. Allowed Conductor Area (Sq. In) : 0.8144

Actual Conductor Area (Sq. In) : 0.6995
ACTUAL PERCENT FILL : 34.36

ALTERNATE SIZE: 2 Inch
Ttl. Alternate Conduit Cross Section (Sq. In.) : 3.356
Maximum Allowable Fill Percent : 40.0

Max. Allowed Conductor Area (Sq. In) : 1.3424

Actual Conductor Area (Sq. In) : 0.6995
ACTUAL ALTERNATE PERCENT FILL : 20.84

BOX FILL CALCULATION
NEC Article 314

Quantity Of Conductors	Conductor Size	Volume Required For 1 Conductor (Cubic Inches)	Total Volume Required
3	14	2.0	6.0
3	12	2.25	6.75
		Total Conductor Volume (Cu.In):	12.75

Quantity Of Ground Conductors	Conductor Size	Volume Required For 1 Conductor (Cubic Inches)	Total Volume Required
1	14	2.0	2.0
1	12	2.25	2.25
		Ground Conductor Volume Based On Largest Conductor (Cu.In):	2.25

Device Strap #	Largest Conductor Connected To Strap	Volume Required For 1 Conductor (Cubic Inches)	Total Volume Based On 2 Deductions
1	14	2.0	4.0
2	12	2.25	4.5
		Total Device Strap Volume (Cu.In):	8.5

Box Fittings	Largest Conductor Contained In Box	Volume Required For 1 Conductor (Cubic Inches)	Total Volume Based On 1 Deduction
Cable Clamps	12	2.25	2.25
		Total Fittings Volume (Cu.In):	2.25

MINIMUM REQUIRED BOX VOLUME (Cu.In.) : 25.75