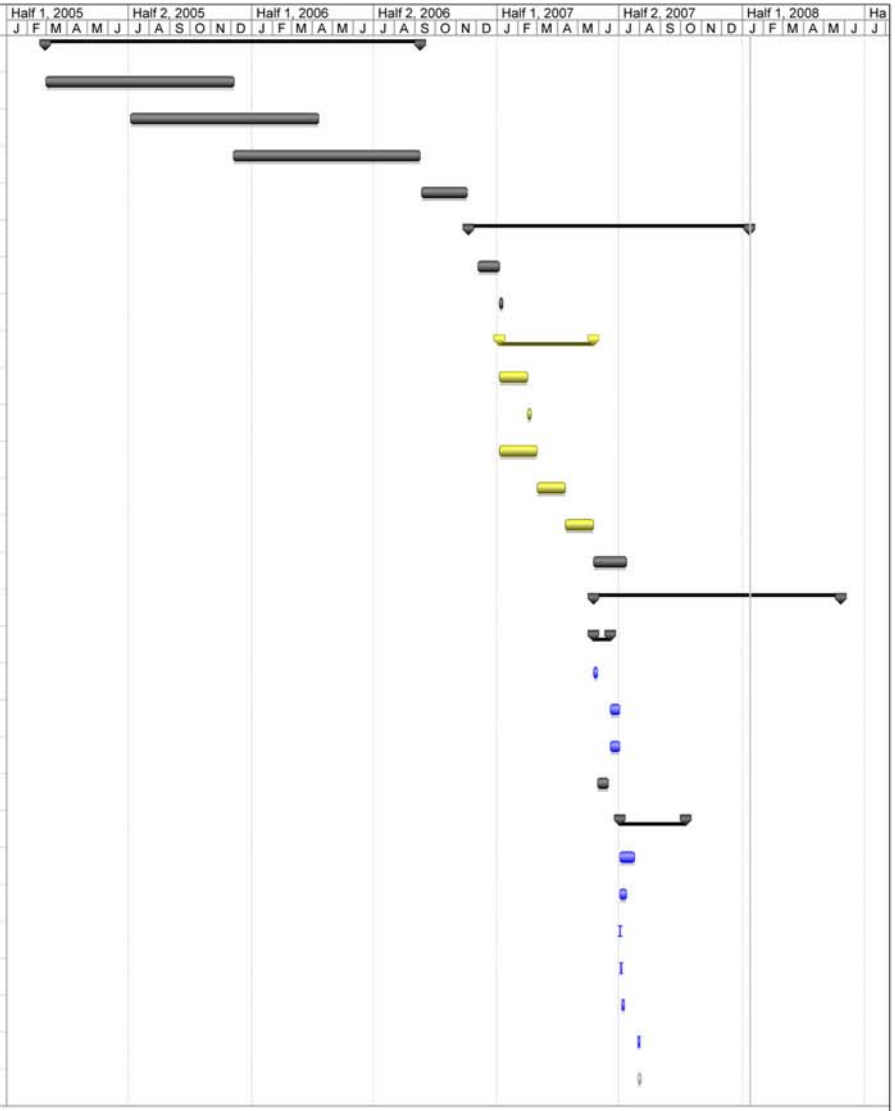
# Appendices

# Appendix A

## Detailed Project schedule

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | **Design Phase** | 400 days | Mon 2/28/05 | Fri 9/8/06 | |
| 2 | Schematic Design | 200 days | Tue 3/1/05 | Mon 12/5/05 | |
| 3 | Design Development | 200 days | Tue 7/5/05 | Mon 4/10/06 | |
| 4 | Construction Documents | 200 days | Mon 12/5/05 | Fri 9/8/06 | |
| 5 | **Bidding** | 50 days | Mon 9/11/06 | Fri 11/17/06 | 4 |
| 6 | **Procurement of construction services** | 300 days | Mon 11/20/06 | Fri 1/11/08 | 5 |
| 7 | **Demolition** | 24 days | Mon 12/4/06 | Thu 1/4/07 | 5FS+10 days |
| 8 | Temporary Electrical Connection | 3 days | Fri 1/5/07 | Tue 1/9/07 | 7 |
| 9 | **Excavation** | 100 days | Fri 1/5/07 | Thu 5/24/07 | 7 |
| 10 | Shoring Pipes | 30 days | Fri 1/5/07 | Thu 2/15/07 | 7 |
| 11 | Pour Shoring Pipes | 3 days | Fri 2/16/07 | Tue 2/20/07 | 10 |
| 12 | Drill Pre-Split holes | 40 days | Fri 1/5/07 | Thu 3/1/07 | 7 |
| 13 | Blasting | 30 days | Fri 3/2/07 | Thu 4/12/07 | 12 |
| 14 | Soil and Rock Removal | 30 days | Fri 4/13/07 | Thu 5/24/07 | 13 |
| 15 | **Contaminated Soil Removal** | 35 days | Fri 5/25/07 | Thu 7/12/07 | 9 |
| 16 | **Construction Phase** | 262 days | Fri 5/25/07 | Mon 5/26/08 | 9 |
| 17 | **Foundations** | 17 days | Fri 5/25/07 | Mon 6/18/07 | 9 |
| 18 | Elevator Slab | 4 days | Fri 5/25/07 | Wed 5/30/07 | 9 |
| 19 | Exterior Footers | 10 days | Tue 6/19/07 | Mon 7/2/07 | 9,17 |
| 20 | Interior Footers | 10 days | Tue 6/19/07 | Mon 7/2/07 | 9,17 |
| 21 | Crane Setup | 12 days | Thu 5/31/07 | Fri 6/15/07 | 18 |
| 22 | **Parking Garage Structure** | 70 days | Tue 7/3/07 | Mon 10/8/07 | 19,21 |
| 23 | Exterior Wall | 16 days | Tue 7/3/07 | Tue 7/24/07 | 19,21 |
| 24 | Colums and Interior Walls 1st Level | 8 days | Tue 7/3/07 | Thu 7/12/07 | 20,21 |
| 25 | Lay Stone for Basement Slab | 1 day | Tue 7/3/07 | Tue 7/3/07 | 19,20 |
| 26 | Install Vapor Barrier | 2 days | Wed 7/4/07 | Thu 7/5/07 | 25 |
| 27 | Instal WWF for Basement Slab | 2 days | Fri 7/6/07 | Mon 7/9/07 | 26 |
| 28 | Beams First Level | 3 days | Mon 7/30/07 | Wed 8/1/07 | 23FS+3 days,24FS+3 days |
| 29 | Ground Flloor CMU Walls | 5 days | Mon 7/30/07 | Fri 8/3/07 | 23FS+3 days,24FS+3 days |

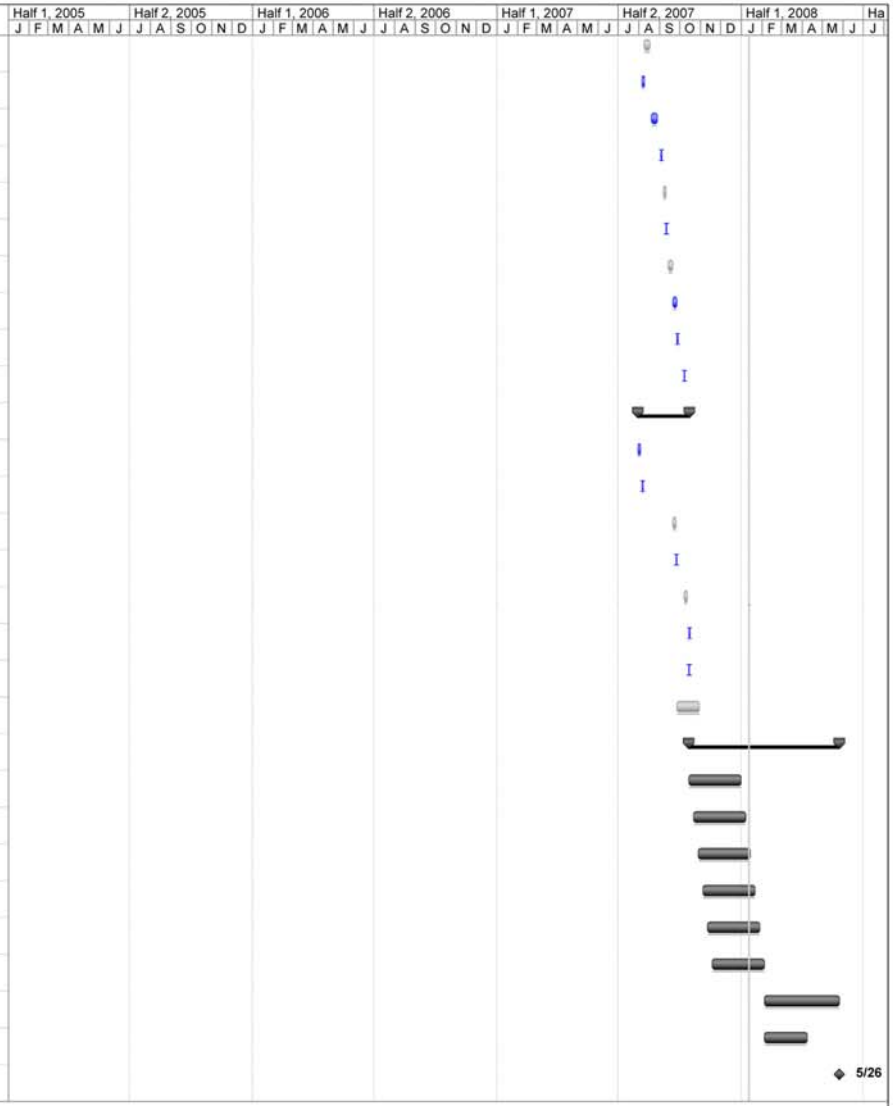



Project: 320 Beaver Ave 2
Date: Sat 1/12/08

Task
Smaller Summary
Overview Summary
Milestone
General Contractor : Poole Anderson Construction
Site Work : Glen O. Hawbaker
Concrete : Lorne G. Seifert
Masonry Work & Plank Setting : Harris Masonry

**Appendix A: Detailed Project Schedule**

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 30 | Precast Floor 2nd level | 7 days | Thu 8/9/07 | Fri 8/17/07 | 28FS+5 days |
| 31 | Basement Slab | 4 days | Mon 8/6/07 | Thu 8/9/07 | 27,29 |
| 32 | Cast in Place Walls 2nd level | 7 days | Mon 8/20/07 | Tue 8/28/07 | 30 |
| 33 | Ground level Beams | 2 days | Mon 9/3/07 | Tue 9/4/07 | 32FS+3 days |
| 34 | Place 2nd level CMU | 2 days | Fri 9/7/07 | Mon 9/10/07 | 32FS+7 days |
| 35 | Pour Topping Slab 2nd level | 1 day | Tue 9/11/07 | Tue 9/11/07 | 34 |
| 36 | Precast Floor Ground Level Parking | 5 days | Fri 9/14/07 | Thu 9/20/07 | 33FS+7 days |
| 37 | Ground Level Parking Walls and Columns | 4 days | Fri 9/21/07 | Wed 9/26/07 | 36 |
| 38 | Beams 2nd Floor Above Parking | 2 days | Thu 9/27/07 | Fri 9/28/07 | 37 |
| 39 | Pour Topping Ground Floor Parking | 1 day | Mon 10/8/07 | Mon 10/8/07 | 37FS+7 days |
| 40 | **Commercial Space Structure** | 55 days | Tue 7/31/07 | Mon 10/15/07 | 23FS+4 days |
| 41 | Commercial Footers | 4 days | Tue 7/31/07 | Fri 8/3/07 | 23FS+4 days |
| 42 | Ground Floor Slab on Grade | 2 days | Mon 8/6/07 | Tue 8/7/07 | 41 |
| 43 | Precast Floor Ground Level Commercial | 3 days | Fri 9/21/07 | Tue 9/25/07 | 36 |
| 44 | Ground Level Walls and Columns | 1 day | Wed 9/26/07 | Wed 9/26/07 | 43 |
| 45 | Ground Floor CMU | 5 days | Mon 10/8/07 | Fri 10/12/07 | 44FS+7 days |
| 46 | Beams 2nd Floor | 2 days | Mon 10/15/07 | Tue 10/16/07 | 45 |
| 47 | Pour Topping Ground Level | 1 day | Mon 10/15/07 | Mon 10/15/07 | 45 |
| 48 | Brick first floor only | 24 days | Thu 9/27/07 | Tue 10/30/07 | 44 |
| 49 | **Apartments** | 161 days | Mon 10/15/07 | Mon 5/26/08 | 38,45 |
| 50 | **Floor 2** | 56 days | Mon 10/15/07 | Mon 12/31/07 | 38,45 |
| 51 | **Floor 3** | 56 days | Mon 10/22/07 | Mon 1/7/08 | 50FS-51 days |
| 52 | **Floor 4** | 56 days | Mon 10/29/07 | Mon 1/14/08 | 51FS-51 days |
| 53 | **Floor 5** | 56 days | Mon 11/5/07 | Mon 1/21/08 | 52FS-51 days |
| 54 | **Floor 6** | 56 days | Mon 11/12/07 | Mon 1/28/08 | 53FS-51 days |
| 55 | **Floor 7** | 56 days | Mon 11/19/07 | Mon 2/4/08 | 54FS-51 days |
| 56 | Finishes | 80 days | Tue 2/5/08 | Mon 5/26/08 | 55 |
| 57 | Landscape | 46 days | Tue 2/5/08 | Tue 4/8/08 | 55 |
| 58 | Occupancy | 0 days | Mon 5/26/08 | Mon 5/26/08 | 57,56 |




Project: 320 Beaver Ave 2
Date: Sat 1/12/08

Task | Smaller Summary | Overview Summary | Milestone

General Contractor : Poole Anderson Construction
Site Work : Glen O. Hawbaker
Concrete : Lorne G. Seifert
Masonry Work & Plank Setting : Harris Masonry

# Appendix A1

## Proposed Project schedule

Appendix A: Green Roof and Mechanical Schedule

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | **Design Phase** | 400 days | Mon 2/28/05 | Fri 9/8/06 | |
| 2 | Schematic Design | 200 days | Tue 3/1/05 | Mon 12/5/05 | |
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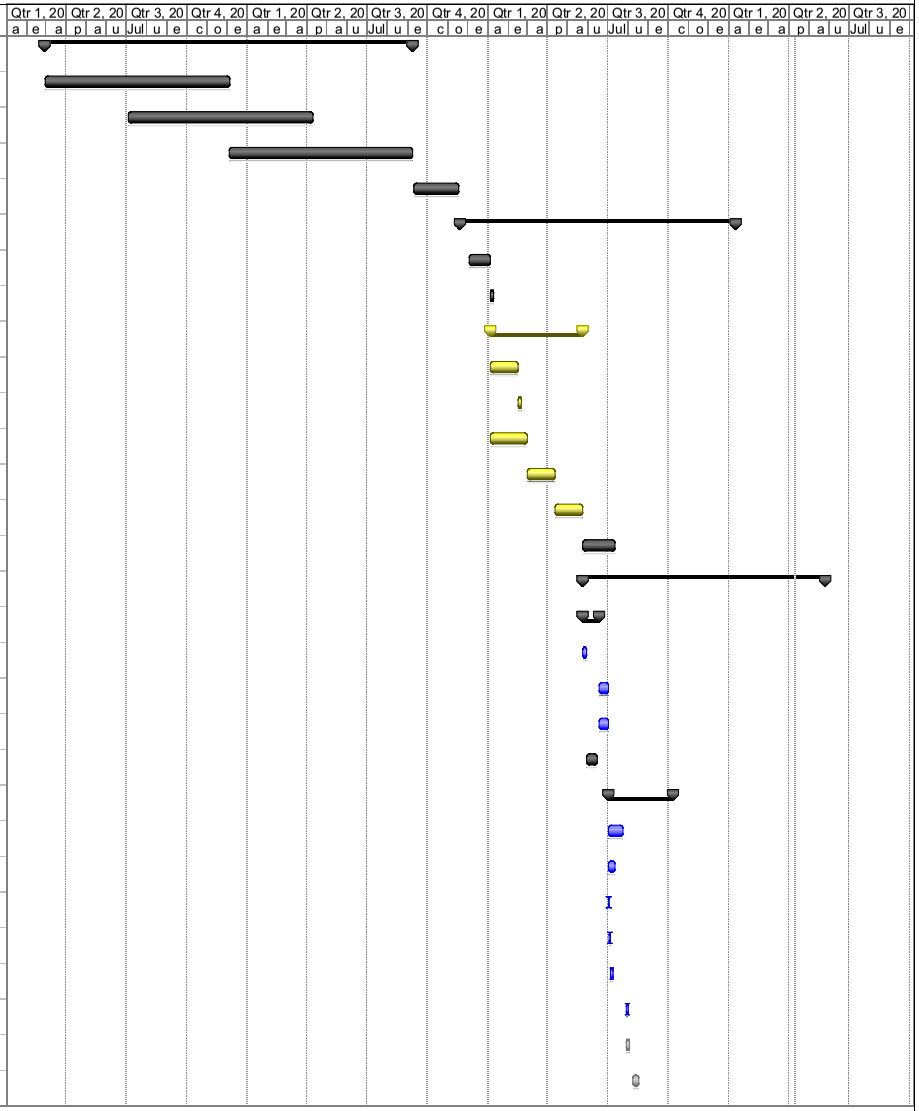


Project: The Palmerton
Date: Thu 4/10/08

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Appendix A: Green Roof and Mechanical Schedule

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 31 | Basement Slab | 4 days | Mon 8/6/07 | Thu 8/9/07 | 27,29 |
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| 33 | Ground level Beams | 2 days | Mon 9/3/07 | Tue 9/4/07 | 32FS+3 days |
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| 47 | Pour Topping Ground Level | 1 day | Mon 10/15/07 | Mon 10/15/07 | 45 |
| 48 | Brick first floor only | 24 days | Thu 9/27/07 | Tue 10/30/07 | 44 |
| 49 | Green Roof | 25 days | Tue 10/16/07 | Mon 11/19/07 | 40 |
| 50 | **Apartments** | 161 days | Mon 10/15/07 | Mon 5/26/08 | 38,45 |
| 51 | **Floor 2** | 56 days | Mon 10/15/07 | Mon 12/31/07 | 38,45 |
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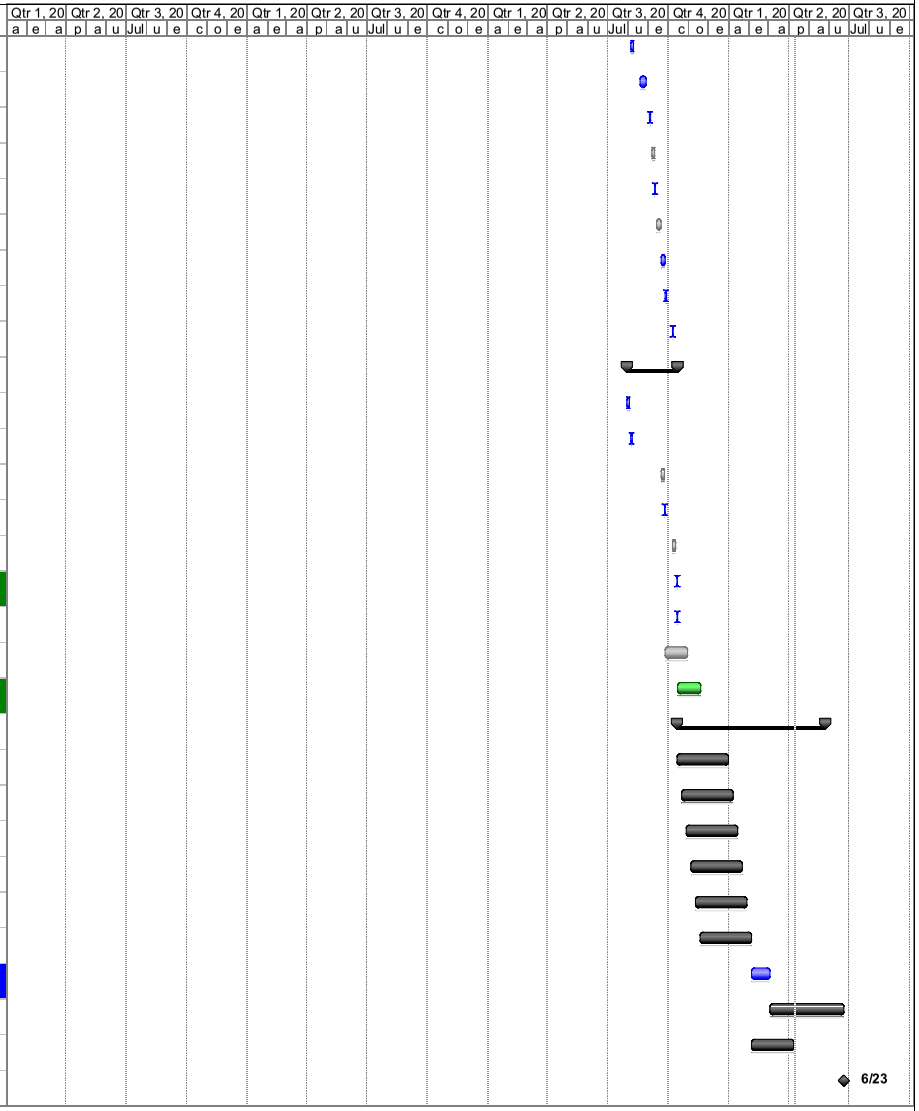
| 56 | **Floor 7** | 56 days | Mon 11/19/07 | Mon 2/4/08 | 55FS-51 days |
| 57 | Water Loop | 20 days | Tue 2/5/08 | Mon 3/3/08 | 56 |
| 58 | Finishes | 80 days | Tue 3/4/08 | Mon 6/23/08 | 57 |
| 59 | Landscape | 46 days | Tue 2/5/08 | Tue 4/8/08 | 56 |
| 60 | Occupancy | 0 days | Mon 6/23/08 | Mon 6/23/08 | 59,58 |




Project: The Palmerton
Date: Thu 4/10/08

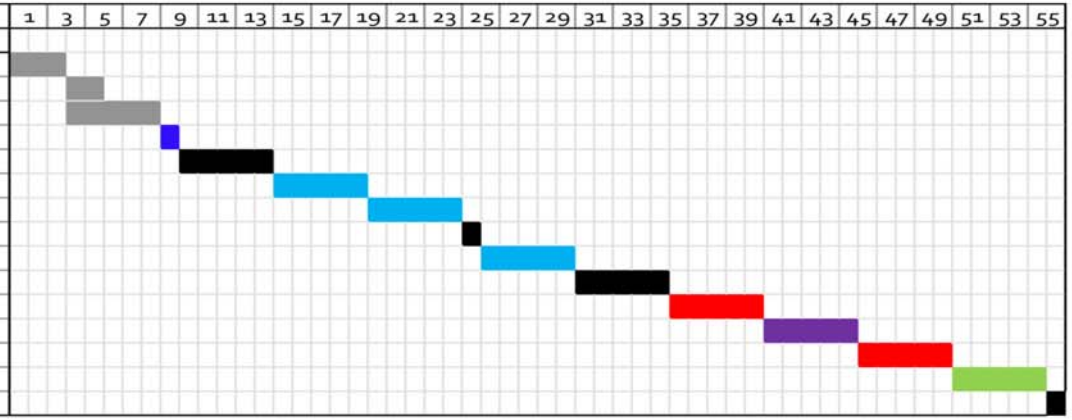
Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

# Appendix B

## SIPS Schedule, Typical Floor Plan

Appendix B: Sips Schedule, Typical Floor Plan

| | Sips Schedule, Typical Floor | | Days |
|---|---|---|---|
| | Task Name | Duration | Predecessor |
| 1 | Hollow Core Planks | 3 days | |
| 2 | Plank Connections | 2 days | 1 |
| 3 | CMU Walls | 5 days | 1 |
| 4 | Pour Topping Slab | 1 day | 2,3 |
| 5 | Exterior Walls | 5 days | 4 |
| 6 | Exterior Sheathing | 5 days | 5 |
| 7 | Water Proofing | 5 days | 6 |
| 8 | Windows | 1 day | 7 |
| 9 | EIFS | 5 days | 8 |
| 10 | Interior Framing | 5 days | 5 |
| 11 | Mechanical Rough-In | 5 days | 10 |
| 12 | Plumbing Rough-In | 5 days | 11 |
| 13 | Electrical Rough-In | 5 days | 13 |
| 14 | Drywall | 5 days | 13 |
| 15 | Paint | 1 day | 15 |




| Legend | |
|---|---|
| Harris Masonry | |
| Lorne G. Seifert | |
| Poole Anderson Construction | |
| Macron Roofing | |
| Allied Mechanical and Electrical | |
| R&R Plaster | |

# Appendix D

## Assemblies Estimate

| Appendix D: Mechanical Assemblies Estimate | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Unit Cost | | Total Cost | | |
| | # | Units | Material Unit Cost | Labor Unit Cost | Material Cost | Labor Cost | Total |
| 2 BR Apartment | | | | | | | |
| Heat Pump | 1 | Each | $2,350.00 | $1,050.00 | $2,350.00 | $1,050.00 | $3,400.00 |
| 14" Flex Duct | 6 | Feet | $3.30 | $6.49 | $19.80 | $38.94 | $58.74 |
| Ductwork | 245 | Lb | $0.46 | $3.21 | $112.70 | $786.45 | $899.15 |
| Diffuser | 3 | Each | $37.50 | $21.50 | $112.50 | $64.50 | $177.00 |
| 6" EXH Duct | 63 | Feet | $3.16 | $2.67 | $199.08 | $168.21 | $367.29 |
| Exhaust Fan | 2 | Each | $55.17 | $31.17 | $110.34 | $62.34 | $172.68 |
| Wall Heater | 2 | Each | $100.00 | $32.00 | $200.00 | $64.00 | $264.00 |
| Total | | | | | $2,904.42 | $2,170.44 | $5,074.86 |
| Total | 55 | | | | $159,743.10 | $119,374.20 | **$279,117.30** |
| | | | | | | | |
| 1 BR Apartment | | | | | | | |
| Heat Pump | 1 | Each | $1,746.00 | $704.00 | $1,746.00 | $704.00 | $2,450.00 |
| 14" Flex Duct | 4 | Feet | $3.30 | $6.49 | $13.20 | $25.96 | $39.16 |
| Ductwork | 80 | Lb | $0.46 | $3.21 | $36.80 | $256.80 | $293.60 |
| Diffuser | 2 | Each | $37.50 | $21.50 | $75.00 | $43.00 | $118.00 |
| 6" EXH Duct | 30 | Feet | $3.16 | $2.67 | $94.80 | $80.10 | $174.90 |
| Exhaust Fan | 1 | Each | $55.17 | $31.17 | $55.17 | $31.17 | $86.34 |
| Wall Heater | 1 | Each | $100.00 | $32.00 | $100.00 | $32.00 | $132.00 |
| Total | | | | | $2,120.97 | $1,173.03 | $3,294.00 |
| Total | 10 | | | | $21,209.70 | $11,730.30 | **$32,940.00** |
| | | | | | | | |
| Roof Top AC | 3 | Each | $4,855.00 | $830.00 | $14,565.00 | $2,490.00 | $17,055.00 |
| Condensing Unit | 1 | Each | $3,250.00 | $533.00 | $3,250.00 | $533.00 | $3,783.00 |
| Make Up AHU | 1 | Each | $5,983.00 | $270.00 | $5,983.00 | $270.00 | $6,253.00 |
| Electric Wall Heaters | 7 | Each | $267.00 | $82.67 | $1,869.00 | $578.69 | $2,447.69 |
| | 3 | Each | $400.00 | $124.00 | $1,200.00 | $372.00 | $1,572.00 |
| | 1 | Each | $400.00 | $124.00 | $400.00 | $124.00 | $524.00 |
| | 2 | Each | $667.00 | $206.67 | $1,334.00 | $413.34 | $1,747.34 |
| Total | | | | | $17,815.00 | $3,023.00 | $33,382.03 |
| | | | | | | | |
| **Total** | | | Location | | 0.96 | | **$437,740.72** |
| | | | Time | | 1.32 | | |

# Appendix E

## Detailed Structural Estimate

| Typical Floor (3-6) Structural Cost | | | | Unit Cost | | | |
|---|---|---|---|---|---|---|---|
| Type | Quantity | Units | Total SF | Material | Labor | Equipment | Total Cost |
| 8" CMU | | SF | | $1.56 | $2.81 | $0.00 | $4.37 |
| | 2 | 505.55 | 1011.10 | $1,577.32 | $2,841.20 | $0.00 | $4,418.53 |
| | 2 | 259.72 | 519.44 | $810.32 | $1,459.62 | $0.00 | $2,269.94 |
| | 4 | 61.11 | 244.46 | $381.36 | $686.93 | $0.00 | $1,068.28 |
| | 2 | 194.45 | 388.90 | $606.68 | $1,092.80 | $0.00 | $1,699.47 |
| | 2 | 148.61 | 297.23 | $463.68 | $835.21 | $0.00 | $1,298.89 |
| | 1 | 134.98 | 134.98 | $210.57 | $379.29 | $0.00 | $589.86 |
| | 1 | 15.97 | 15.97 | $24.91 | $44.87 | $0.00 | $69.78 |
| | 1 | 61.80 | 61.80 | $96.41 | $173.66 | $0.00 | $270.08 |
| | 1 | 145.83 | 145.83 | $227.50 | $409.79 | $0.00 | $637.29 |
| | 2 | 287.16 | 574.31 | $895.93 | $1,613.82 | $0.00 | $2,509.75 |
| | 4 | 250.70 | 1002.79 | $1,564.36 | $2,817.84 | $0.00 | $4,382.20 |
| | 2 | 306.59 | 613.19 | $956.57 | $1,723.06 | $0.00 | $2,679.63 |
| | 2 | 616.67 | 1233.33 | $1,924.00 | $3,465.67 | $0.00 | $5,389.67 |
| | 2 | 399.05 | 798.11 | $1,245.05 | $2,242.68 | $0.00 | $3,487.73 |
| | 4 | 250.70 | 1002.79 | $1,564.36 | $2,817.84 | $0.00 | $4,382.20 |
| | 2 | 297.22 | 594.44 | $927.32 | $1,670.37 | $0.00 | $2,597.69 |
| | 1 | 157.99 | 157.99 | $246.46 | $443.95 | $0.00 | $690.41 |
| | 2 | 125.70 | 251.40 | $392.18 | $706.42 | $0.00 | $1,098.60 |
| | 1 | 79.51 | 79.51 | $124.04 | $223.42 | $0.00 | $347.46 |
| | 1 | 28.47 | 28.47 | $44.41 | $80.00 | $0.00 | $124.41 |
| | 1 | 78.47 | 78.47 | $122.41 | $220.50 | $0.00 | $342.91 |
| | 2 | 258.33 | 516.67 | $806.00 | $1,451.83 | $0.00 | $2,257.83 |
| | 2 | 116.67 | 233.33 | $364.00 | $655.67 | $0.00 | $1,019.67 |
| | 1 | 42.36 | 42.36 | $66.09 | $119.04 | $0.00 | $185.13 |
| Doors RO | 2 | 20.56 | 41.12 | $64.15 | $115.55 | $0.00 | $179.69 |
| | 15 | 22.22 | 333.30 | $519.95 | $936.57 | $0.00 | $1,456.52 |
| | 6 | 26.67 | 160.02 | $249.63 | $449.66 | $0.00 | $699.29 |
| Window RO | 1 | 7.75 | 7.75 | $12.09 | $21.78 | $0.00 | $33.87 |
| Total | | | 9484.68 | $14,796.10 | $26,651.95 | $0.00 | $41,448.05 |
| 10" CMU | | SF | | $2.18 | $3.46 | $0.00 | $5.64 |
| Total | 1 | 140.00 | 140.00 | $305.20 | $484.40 | $0.00 | $789.60 |
| 8" Hollow Core Plank | | SF | | $5.00 | $0.75 | $0.53 | $6.28 |
| Total | | 13971.10 | 13971.10 | $69,855.50 | $10,478.33 | $7,404.68 | $87,738.51 |
| Topping Slab | | CY | | $74.00 | $10.15 | $4.70 | |
| Total | | 91.00 | 91.00 | $6,734.00 | $923.65 | $427.70 | $8,085.35 |
| Steel | | LF | | $12.13 | $3.10 | $2.37 | $17.60 |
| W 8X18 | 10 | 8.67 | 86.67 | $1,051.27 | $268.67 | $205.40 | $1,525.33 |
| W 8X18 | 10 | 6.33 | 63.33 | $768.23 | $196.33 | $150.10 | $1,114.67 |
| Total | | | 150.00 | $1,819.50 | $465.00 | $355.50 | $2,640.00 |
| | | | | | | | |
| **Total** | All 4 Floors | | | **$98,968.80** | **$40,398.32** | **$9,254.38** | **$562,806.02** |

| Floor 7 Structural Cost | | | | Unit Cost | | | |
|---|---|---|---|---|---|---|---|
| Type | uanti | Units | Total SF | Material | Labor | Equipment | Total Cost |
| 8" CMU | | SF | | $1.56 | $2.81 | $0.00 | $4.37 |
| | 2 | 185.33 | 370.66 | $578.23 | $1,041.55 | $0.00 | $1,619.78 |
| | 1 | 129.58 | 129.58 | $202.14 | $364.12 | $0.00 | $566.26 |
| | 1 | 15.33 | 15.33 | $23.91 | $43.08 | $0.00 | $66.99 |
| | 1 | 59.33 | 59.33 | $92.55 | $166.72 | $0.00 | $259.27 |
| | 1 | 134.67 | 134.67 | $210.09 | $378.42 | $0.00 | $588.51 |
| | 2 | 275.67 | 551.34 | $860.09 | $1,549.27 | $0.00 | $2,409.36 |
| | 2 | 592.00 | 1184.00 | $1,847.04 | $3,327.04 | $0.00 | $5,174.08 |
| | 4 | 240.67 | 962.68 | $1,501.78 | $2,705.13 | $0.00 | $4,206.91 |
| | 2 | 383.09 | 766.18 | $1,195.24 | $2,152.97 | $0.00 | $3,348.21 |
| | 2 | 240.67 | 481.34 | $750.89 | $1,352.57 | $0.00 | $2,103.46 |
| | 1 | 285.33 | 285.33 | $445.11 | $801.78 | $0.00 | $1,246.89 |
| | 1 | 151.67 | 151.67 | $236.61 | $426.19 | $0.00 | $662.80 |
| | 3 | 120.67 | 362.01 | $564.74 | $1,017.25 | $0.00 | $1,581.98 |
| | 1 | 40.33 | 40.33 | $62.91 | $113.33 | $0.00 | $176.24 |
| | 1 | 71.00 | 71.00 | $110.76 | $199.51 | $0.00 | $310.27 |
| Doors RO | 2 | 20.56 | 41.12 | $64.15 | $115.55 | $0.00 | $179.69 |
| | 15 | 22.22 | 333.30 | $519.95 | $936.57 | $0.00 | $1,456.52 |
| | 6 | 26.67 | 160.02 | $249.63 | $449.66 | $0.00 | $699.29 |
| Window RO | 1 | 7.75 | 7.75 | $12.09 | $21.78 | $0.00 | $33.87 |
| Total | | | 5023.26 | $7,836.29 | $14,115.36 | $0.00 | $21,951.65 |
| 10" CMU | | SF | | $2.18 | $3.46 | $0.00 | $5.64 |
| Total | 1 | 140.00 | 140.00 | $305.20 | $484.40 | $0.00 | $789.60 |
| 8" Hollow Core Plank | | SF | | $5.00 | $0.75 | $0.53 | $6.28 |
| | 1 | 13971.10 | 13971.10 | $69,855.50 | $10,478.33 | $7,404.68 | $87,738.51 |
| | 1 | 7522.00 | 7522.00 | $37,610.00 | $5,641.50 | $3,986.66 | $47,238.16 |
| Total | | | 21493.10 | $107,465.50 | $16,119.83 | $11,391.34 | $134,976.67 |
| Topping Slab | | CY | | $74.00 | $10.15 | $4.70 | $88.85 |
| | 1 | 91.00 | 91.00 | $6,734.00 | $923.65 | $427.70 | $8,085.35 |
| | 1 | 46.43 | 46.43 | $3,435.82 | $471.26 | $218.22 | $4,125.31 |
| Total | | | 137.43 | $10,169.82 | $1,394.91 | $645.92 | $12,210.66 |
| Steel | | LF | | $12.13 | $3.10 | $2.37 | $17.60 |
| W 8X18 | 5 | 8.67 | 43.33 | $525.63 | $134.33 | $102.70 | $762.67 |
| W 8X18 | 5 | 6.33 | 31.67 | $384.12 | $98.17 | $75.05 | $557.33 |
| Total | | | 75.00 | $909.75 | $232.50 | $177.75 | $1,320.00 |
| | | | | | | | |
| **Total** | | | | **$126,686.56** | **$32,347.00** | **$12,215.01** | **$171,248.57** |

| Floor 2 Structural Cost | | | | Unit Cost | | | |
|---|---|---|---|---|---|---|---|
| Type | Quantity | Units | Total SF | Material | Labor | Equipment | Total Cost |
| Cast in Place | | CY | | $134.09 | $97.73 | $12.46 | $244.28 |
| | 2 | 14.30 | 28.61 | $3,835.85 | $2,795.62 | $356.50 | $6,987.97 |
| | 2 | 7.35 | 14.70 | $1,970.60 | $1,436.20 | $183.14 | $3,589.95 |
| | 4 | 1.73 | 6.92 | $927.41 | $675.91 | $86.19 | $1,689.51 |
| | 2 | 5.50 | 11.00 | $1,475.36 | $1,075.26 | $137.12 | $2,687.75 |
| | 2 | 4.20 | 8.41 | $1,127.61 | $821.81 | $104.80 | $2,054.22 |
| | 1 | 3.82 | 3.82 | $512.07 | $373.21 | $47.59 | $932.87 |
| | 1 | 0.45 | 0.45 | $60.58 | $44.15 | $5.63 | $110.36 |
| | 1 | 1.75 | 1.75 | $234.46 | $170.88 | $21.79 | $427.13 |
| | 1 | 4.13 | 4.13 | $553.25 | $403.22 | $51.42 | $1,007.89 |
| | 2 | 8.12 | 16.25 | $2,178.78 | $1,587.93 | $202.49 | $3,969.20 |
| | 4 | 7.09 | 28.37 | $3,804.32 | $2,772.64 | $353.56 | $6,930.52 |
| | 2 | 8.67 | 17.35 | $2,326.26 | $1,695.41 | $216.20 | $4,237.88 |
| | 2 | 17.45 | 34.89 | $4,678.93 | $3,410.07 | $434.85 | $8,523.84 |
| | 2 | 11.29 | 22.58 | $3,027.80 | $2,206.70 | $281.40 | $5,515.90 |
| | 4 | 7.09 | 28.37 | $3,804.32 | $2,772.64 | $353.56 | $6,930.52 |
| | 2 | 8.41 | 16.82 | $2,255.13 | $1,643.57 | $209.59 | $4,108.29 |
| | 1 | 4.47 | 4.47 | $599.37 | $436.83 | $55.70 | $1,091.90 |
| | 2 | 3.56 | 7.11 | $953.73 | $695.09 | $88.64 | $1,737.45 |
| | 1 | 2.25 | 2.25 | $301.64 | $219.84 | $28.03 | $549.51 |
| | 1 | 0.81 | 0.81 | $108.00 | $78.71 | $10.04 | $196.75 |
| | 1 | 2.22 | 2.22 | $297.69 | $216.96 | $27.67 | $542.31 |
| | 2 | 7.31 | 14.62 | $1,960.09 | $1,428.54 | $182.17 | $3,570.80 |
| | 2 | 3.30 | 6.60 | $885.20 | $645.15 | $82.27 | $1,612.62 |
| | 1 | 1.20 | 1.20 | $160.72 | $117.13 | $14.94 | $292.79 |
| Doors RO | 2 | 0.58 | 1.16 | $156.00 | $113.69 | $14.50 | $284.19 |
| | 15 | 0.63 | 9.43 | $1,264.45 | $921.55 | $117.52 | $2,303.51 |
| | 6 | 0.75 | 4.53 | $607.07 | $442.44 | $56.42 | $1,105.93 |
| Window RO | 1 | 0.22 | 0.22 | $29.40 | $21.43 | $2.73 | $53.56 |
| Total | | | 268.34 | $35,982.26 | $26,224.36 | $3,344.11 | $65,550.73 |
| 10" CMU | | SF | | $2.18 | $3.46 | $0.00 | $5.64 |
| Total | 1 | 140.00 | 140.00 | $305.20 | $484.40 | $0.00 | $789.60 |
| 8" Precast Planks | | SF | | $5.00 | $0.75 | $0.53 | $6.28 |
| Total | | 13971.10 | 13971.10 | $69,855.50 | $52,391.63 | $27,767.56 | $150,014.69 |
| Topping Slab | | CY | | $74.00 | $10.15 | $4.70 | |
| Total | | 91.00 | 91.00 | $6,734.00 | $923.65 | $427.70 | $8,085.35 |
| Steel | | LF | | $12.13 | $3.10 | $2.37 | $17.60 |
| W 8X18 | 10 | 8.67 | 86.67 | $1,051.27 | $268.67 | $205.40 | $1,525.33 |
| W 8X18 | 10 | 6.33 | 63.33 | $768.23 | $196.33 | $150.10 | $1,114.67 |
| Total | | | 150.00 | $1,819.50 | $465.00 | $355.50 | $2,640.00 |
| | | | | | | | |
| **Total** | | | | **$114,696.46** | **$80,489.03** | **$31,894.87** | **$227,080.36** |

| Footers | | | | Unit Cost | | | |
|---|---|---|---|---|---|---|---|
| Spread | | CY | | $92.00 | $40.00 | $0.44 | $132.44 |
| | 32 | 7.88 | 252.16 | $23,198.72 | $708.57 | $0.00 | $23,907.29 |
| Strip Edge | | CY | | $92.50 | $52.50 | $0.58 | $145.58 |
| Footer | 1 | 237.00 | 237.00 | $21,922.50 | $12,442.50 | $137.46 | $34,502.46 |
| Strip Interior | | CY | | $29.78 | $25.74 | $0.00 | $55.52 |
| Footer 5'X1'8" | 1 | 92.00 | 92.00 | $2,739.76 | $2,368.08 | $0.00 | $5,107.84 |
| Strip Interior | | CY | | $11.26 | $14.54 | $0.00 | $25.80 |
| Footer 2'X1' | 1 | 9.00 | 9.00 | $9,461.40 | $2,418.00 | $1,848.60 | $13,728.00 |
| Strip Interior | | CY | | $92.50 | $52.50 | $0.58 | $145.58 |
| Footer 3'X1' | 1 | 16.50 | 16.50 | $1,526.25 | $866.25 | $9.57 | $2,402.07 |
| **Total** | | | | $58,848.63 | $18,803.40 | $1,995.63 | **$79,647.66** |
| **Parking Garage** | | | | | | | |
| Extrerior Wall | | CY | | $149.00 | $219.00 | $26.50 | $394.50 |
| | 1 | 481.00 | 481.00 | $71,669.00 | $105,339.00 | $12,746.50 | $189,754.50 |
| Slab on Grade | | SF | | $1.15 | $0.55 | $0.01 | $1.71 |
| | 1 | 25711.00 | 25711.00 | $29,567.65 | $14,141.05 | $257.11 | $43,965.81 |
| Precast Panels | | | | $5.00 | $0.75 | $0.53 | $6.28 |
| | 1 | 26730.00 | 26730.00 | $133,650.00 | $20,047.50 | $14,166.90 | $167,864.40 |
| 1st Level | | | | | | | |
| Interior Walls | | | | | | | |
| 1'-4" | | CY | | $139.00 | $54.00 | $6.95 | $199.95 |
| | 8 | 22.76 | 182.08 | $25,309.12 | $9,832.32 | $1,265.46 | $36,406.90 |
| 1'-0" | | CY | | $158.00 | $91.50 | $11.70 | $261.20 |
| | 1 | 0.46 | 0.46 | $72.68 | $42.09 | $5.38 | $120.15 |
| | 1 | 3.88 | 3.88 | $613.04 | $355.02 | $45.40 | $1,013.46 |
| | 1 | 0.08 | 0.08 | $12.64 | $7.32 | $0.94 | $20.90 |
| | 1 | 1.51 | 1.51 | $238.58 | $138.17 | $17.67 | $394.41 |
| | 2 | 0.44 | 0.88 | $139.04 | $80.52 | $10.30 | $229.86 |
| | 2 | 0.93 | 1.86 | $293.88 | $170.19 | $21.76 | $485.83 |
| | 1 | 0.94 | 0.94 | $148.52 | $86.01 | $11.00 | $245.53 |
| Total | | | 2.80 | $1,518.38 | $879.32 | $112.44 | $2,510.13 |
| Columns | | CY | | $139.00 | $91.50 | $11.70 | $242.20 |
| 1'-4" | 16 | 2.46 | 39.36 | $5,471.04 | $3,601.44 | $460.51 | $9,532.99 |
| CMU Walls 8" | | CY | | $1.56 | $2.81 | $0.00 | $4.37 |
| | 3 | 9.56 | 28.68 | $44.74 | $80.59 | $0.00 | $125.33 |
| | 1 | 14.21 | 14.21 | $22.17 | $39.93 | $0.00 | $62.10 |
| | 1 | 19.00 | 19.00 | $29.64 | $53.39 | $0.00 | $83.03 |
| | 1 | 20.00 | 20.00 | $31.20 | $56.20 | $0.00 | $87.40 |
| | 1 | 5.83 | 5.83 | $9.09 | $16.38 | $0.00 | $25.48 |
| | 1 | 13.11 | 13.11 | $20.45 | $36.84 | $0.00 | $57.29 |
| Total | | | 18.94 | $157.29 | $283.33 | $0.00 | $440.63 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| T Beams | | LF | | | $147.80 | $11.47 | $0.00 | $159.27 |
| | 1 | 1348.19 | 1348.19 | | $199,262.48 | $15,463.74 | $0.00 | $214,726.22 |
| 1'-0" | | CY | | | $158.00 | $91.50 | $11.70 | $261.20 |
| | 1 | 484.00 | 484.00 | | $76,472.00 | $44,286.00 | $5,662.80 | $126,420.80 |
| **Total** | | | | | $86.13 | $13.25 | $7.07 | **$840,072.40** |
| | | | | | | | | |
| **Commercial** | | | | | Unit Cost | | | |
| Precast Panels | | SF | | | $5.00 | $0.75 | $0.53 | $6.28 |
| | 1 | 6980.00 | 6980.00 | | $34,900.00 | $5,235.00 | $3,699.40 | $43,834.40 |
| | 1 | 6365.86 | 6365.86 | | $31,829.30 | $4,774.40 | $3,373.91 | $39,977.60 |
| Total | | | 13345.86 | | $343,038.46 | $70,196.28 | $7,073.31 | $83,812.00 |
| Slab on Grade | | CY | | | $84.50 | $43.00 | $0.58 | $128.08 |
| | 1 | 18.00 | 18.00 | | $1,521.00 | $774.00 | $10.44 | $2,305.44 |
| Columns | | CY | | | $139.00 | $54.00 | $6.95 | $199.95 |
| 1'-4" | 2 | 2.28 | 4.56 | | $633.84 | $246.24 | $31.69 | $911.77 |
| Strip Footer | | CY | | | $92.50 | $52.50 | $0.58 | $145.58 |
| 3'X1' | 1 | 16.50 | 16.50 | | $1,526.25 | $866.25 | $9.57 | $2,402.07 |
| | | CY | | | $92.00 | $40.00 | $0.44 | $132.44 |
| Spread Footings | 8 | 12.77 | 102.16 | | $9,398.72 | $4,086.40 | $44.95 | $13,530.07 |
| Strip Footer | | CY | | | $11.26 | $14.50 | $0.00 | $25.76 |
| 2'X1' | 1 | 18.00 | 18.00 | | $202.68 | $261.00 | $0.00 | $463.68 |
| Footers | | CY | | | $84.50 | $43.00 | $0.58 | $128.08 |
| | 1 | 18.00 | 18.00 | | $1,521.00 | $774.00 | $10.44 | $2,305.44 |
| CMU Walls | | SF | | | $1.56 | $2.81 | $0.00 | $4.37 |
| | 1 | 927.00 | 927.00 | | $1,446.12 | $2,604.87 | $0.00 | $4,050.99 |
| Steel | | LF | | | $23.50 | $2.29 | $1.75 | $27.54 |
| W12X35 | 1 | 20.00 | 20.00 | | $470.00 | $45.80 | $35.00 | $550.80 |
| Steel | | Each | | | $660.00 | $38.50 | $29.50 | $728.00 |
| HSS 12X8X5/8 | 1 | 8.00 | 8.00 | | $5,280.00 | $308.00 | $236.00 | $5,824.00 |
| Steel | | Lb | | | $0.43 | $0.38 | $0.00 | $0.81 |
| L6X6X5/8 | 1 | 4646.40 | 4646.40 | | $1,997.95 | $1,765.63 | $0.00 | $3,763.58 |
| **Total** | | | | | $49,703.49 | $12,242.89 | $3,806.49 | **$119,919.85** |

| | | | |
|---|---|---|---|
| **Total** | Time Factor | $0.96 | **$2,535,381.89** |
| | Location Factor | $1.32 | |

# Appendix C

## Site Layout Planning

C-1



Site Plan Existing Cosditions

Drawn By: Kyle Macht
Date: 12/10/2007

Scale: 1/32" = 1'-0"  Technical Assignment 1

320 W. Beaver Ave.

State College, PA

South Burrowes Street

W Highland Alley

Beaver Ave.

South Atherton Street

Balfurd Cleaners

Bethune United Methodist Church & St. John's United Methodist Church

Site Office
Church Basement

Temporary Parking

Existing Garage

310 - 314 W Beaver Ave.

320 W Beaver Ave. OLD

176' to Fire Hydrant

112' to Fire Hydrant

0' 5' 10' 20' 40'

Property Line
Existing Buildings
Existing Buildings Demolished
Building Perimeter
Building Above Ground Level
Building Below Ground Level
Existing Trees
Existing Communication Line
Existing Gas Line
Existing Sewer Line
New Sewer Line
Existing Storm Sewer Line
New Sanitary Line
Existing Water Line
Existing Water Valve
Existing Fire Hydrant
Street Light
Temporary Services
Traffic Flow

C - 2



Drawn By: Kyle Macht
Date: 01/12/2007

Scale: 1/32" = 1'-0"  Technical Assignment 2

# Excavation Construction Site Plan

320 W. Beaver Ave.

State College, PA

South Burrowes Street

South Atherton Street

W Highland Alley

Beaver Ave.

Balfurd Cleaners

Bethune United Methodist Church & St. John's United Methodist Church

Church Basement

Site Office

Temporary Parking

Toilets

Dumpster

Property Line
Existing Buildings
Existing Trees
Existing Poles
Temporary Services
Toilets
Dumpster
Ramp
Traffic Flow
Pedestrian Flow

0' 5' 10' 20' 40'

C-3
Structural Construction Site Plan
320 W. Beaver Ave.
State College, PA
Drawn By: Kyle Macht
Date: 01/12/2007
Scale: 1/32" = 1'-0"
Technical Assignment 2
South Atherton Street
South Burrowes Street
W Highland Alley
Beaver Ave.
Balfurd Cleaners
Bethune United Methodist Church & St. John's United Methodist Church
Dumpster
Temporary Parking
Site Office
Church Basement
Toilets
Property Line
Existing Buildings
Building Footprint
Building Above Ground Level
Building Below Ground Level
Crane
Existing Trees
Temporary Services
Toilets
Dumpster
Porta-Pots
Cones
Traffic Flow
Pedestrian Flow
0'
5'
10'
20'
40'

C-4



Drawn By: Kyle Macht
Date: 03/12/2007

Finishes Construction Site Plan

Scale: 1/32" = 1'-0"  Technical Assignment 2

320 W. Beaver Ave.

State College, PA

South Atherton Street

South Burrowes Street

W Highland Alley

Beaver Ave.

Balfurd Cleaners

Bethune United Methodist Church & St. John's United Methodist Church

Site Office
Church Basement

Temporary Parking

Toilets

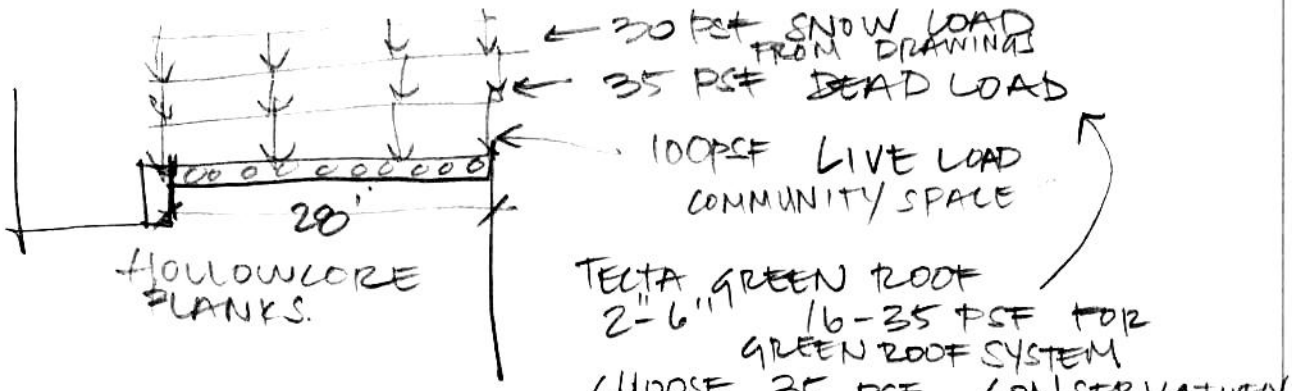
Dumpster

Property Line
Existing Buildings
Building Removal
Building At Ground Level
Building Below Ground Level
Existing Trees
Temporary Services
Toilets
Dumpster
Pay Meters
Cones
Traffic Flow
Pedestrian Flow

0' 5' 10' 20' 40'

# Appendix G

## Structural Calculations, **Breadth 1**




100 PSF LIVE + 35 PSF DEAD.

135 PSF > 133PSF ∴ UP THE PLANK TO 10" 8" EXISTING W/ 15 STRANDS 28' SPAN.

135 PSF < 197 PSF FOR 8'x10" PLANK 15 STRANDS

SUPERIMPOSED LOAD WITH 10" PLANK

135 + 95.65 = **230.65 PSF**

LOAD COMBINATION

1.2 D + 1.6L + 0.5S

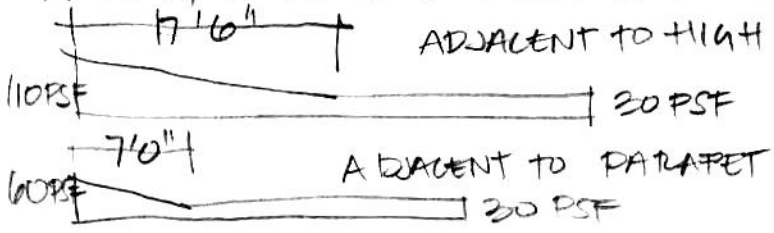
1.2(95.65+35) + 1.6(100) + 0.5(30) = **331.78 PSF**

---

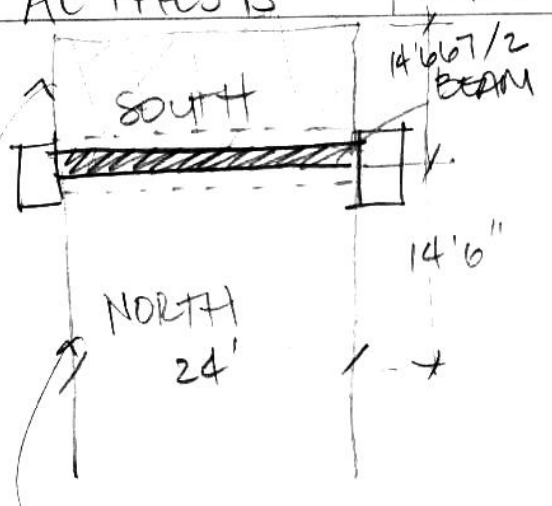
- 10" HOLLOWCORE PLANK TAKEN FROM WM. S. LONG INC., THE PLANK SUPPLIER
- SNOW IS NOT A FACTOR DUE TO THE LIVE LOAD

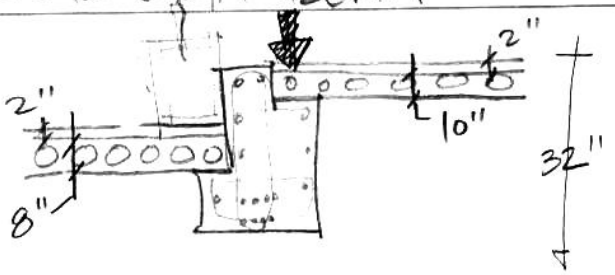
DRIFT LOAD

PRECAST SUPLIER ENSURED SNOW LOADS FOR STATE COLLEGE



AE THESIS | STRUCTURAL BREADTH BEAM




NORTH

SAFE SUPERIMPOSED LOAD

230.14 PSF · 14'6" = 3344.425 PLF

LOAD COMBINATION

331.78 PSF · 14'6" = 4810.81 PLF

SOUTH

SAFE SUPERIMPOSED LOAD

$\frac{14.667'}{2}(20 + 35 + 87.6) = 1045.76$ PLF

LOAD COMBINATION

$\frac{14.667'}{2}((20)(1.6) + (35 + 87.6)(1.2) + (30)(.5)) = 1423.55$ PLF

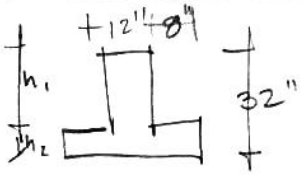
PLANTER BOX

35 PSF · .3 + 2X8 FRAMING W/ BRICK = 125 PLF

4" → 12"

LOAD COMBINATION 125 · 1.2 = 150 PLF

ASSUME PCI




$h_1/h_2 = 20/12$

600 PLF

SAFE SUPERIMPOSED LOAD

3344.425 + 1045.76 + 125 = 4515.19 PLF

@ 24' SPAN 7,521 PLF

4515.19 PLF < 7,521 ∴ OK

LOAD COMBINATION 4810.81 + 1423.55 + 150 + 600 · 1.2

= 7104.36 PLF

① ASSUMING SAME $h_1/h_2$ ON EACH SIDE HIGHER LOAD WILL HAVE A LARGER $h_1/h_2$ ANYWAYS. MEANING IT CAN SUPPORT MORE.

② ASSUMING NO TORSIONAL FACTOR.

BUILDING DESIGNED FOR AN 8TH FLOOR THEREFORE THE WEIGHT OF THAT FLOOR CAN CANCEL OUT THE ADDED WEIGHT FROM THE GREEN ROOF WITH RESPECT TO THE BEAMS.

---

ADDITIONAL WEIGHT IN THE COLUMNS

80 PSF LIVE LOAD ADDITIONAL
20 PSF DEAD LOAD
- ASSUMING 15 PSF FOR REGULAR ROOF DEAD LOAD.

95.65 - 87.6 = 8.05 PSF DEAD LOAD FROM 10" PLANK

$(80)1.6 + (20+8.05)1.2 = 161.66$ PSF

$161.66 \cdot 14'6" = 2344.07$ PLF

PLANTER BOX 150 PLF
20PSF FOR NORTH ROOF $(20) \cdot \frac{14.67}{2} = 176.04$ PLF

$2344.07 + 150 + 176.04 =$ **2670.11 PLF**

$2670.11 \text{ PLF} \left(\frac{23'8"}{2} + \frac{12'}{6}\right) =$ **47,616.96 lbs**

**47.62 KIPS**

AREA WITH LARGEST INCREASE IN WEIGHT IF 8TH FLOOR WAS ADDED

---

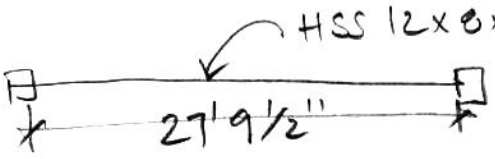
8TH FLOOR WEIGHT

- $200 SF \cdot (87.6 \cdot 1.2 + 40 \cdot 1.6) = 33,824$ lbs
- $\times 9' = 119.25$ SF $\cdot 69$ psf $= 8228.25$ lbs (CMU WALLS)
- STUD WALLS (INTERIOR) 8 PSF $29' \times 8'2"$ $= 1894.67$ lbs
- EXTERIOR 16 PSF $17.83' \times 8'2"$ $= 2329.79$ lbs
- ½ GYPSUM 2 PSF $44' \times 8'2"$ $= 718.67$ lbs
- FLOOR FINISH 2 PSF 200 SF $= 400$ lbs
- W8X18 $6'4" + 9'$ $15.33 \cdot 18 = 276$ lbs.

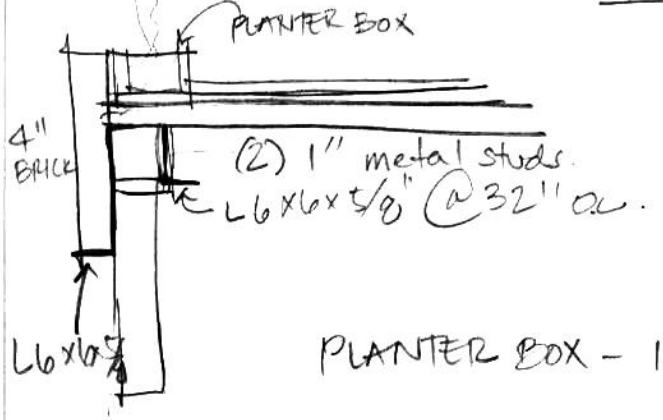
TOTAL $= 47671.37$

47.67K > 47.62K
∴ OK

AE THESIS | STRUCTURAL BREADTH | STEEL BEAM




LOAD COMBINATION = **4010.81 PLF**




PLANTER BOX - 121 PLF

| | | | |
|---|---|---|---|
| - BRICK | 39 PSF | 3'1 1/2" | = 121.88 PLF |
| 2X4 | | | |
| - 2x4 w/ 1/2 GYP | 8 PSF | 2.3' | = 18.4 PLF |
| -(2) 2X1" | 8 PSF | 1'1" | = 8.67 PLF |
| - 1/2.5 | L 6x6x5/8 | @ 34" o.c. | = 9.68 PLF |
| | L 6x6x5/8 | | = 24.2 PLF |
| | TOTAL | | = 182.83 PLF |

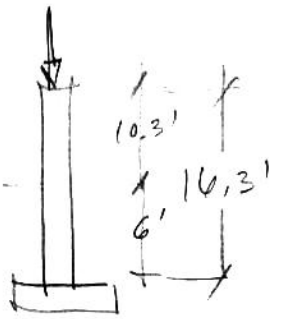
(121 + 182.83) 1.2 = 364.6 PLF

TOTAL 4810.81 + 364.6 = **5175.41 PLF**

$$M_n = \frac{wl^2}{12} = \frac{5175.41 \cdot 28^2}{12} = 338.126 \text{ k-ft}$$

**HSS 14x10x5/8 414 k-ft** 93.1 PLF SELF WEIGHT

AE THESIS | STRUCTURAL BREADTH | STEEL COLUMN




5175.41 PLF + (93.1)1.2

5287.13 PLF · 24'

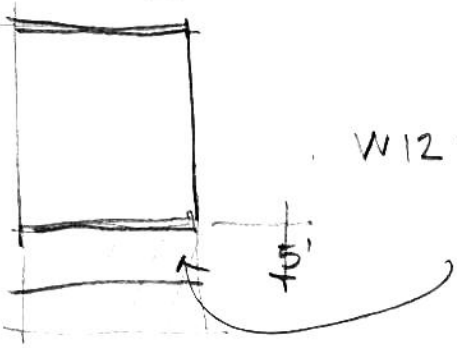
**126.89 kips**

**HSS 10 x 5 x 1/4** $\phi_c P_n = 157$ ∴ ok

24.1 PLF

---

Green Roof Hole




W12 x 35 (EXISTING)

331.78 PSF x 5' = 1658.9 PLF

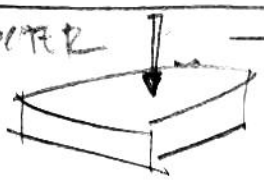
$M_n = \frac{wl^2}{8} = \frac{1658.9(24)^2}{8}$ = **119.44 k-ft**

W12 x 35 @ 24' = 64 k-ft ∴ NO GOOD

**W12 x 72 @ 24' = 135 k-ft ∴ OK**

---

FOOTER



126.89 kips + $\frac{24.1 \cdot 16}{1000}(1.2)$

**= 127.35 kips**

FROM RS MEANS. 2008.

150 k/f SOIL CAPACITY 3 ksf

**= 7'6" SQUARE 18" DEEP**

# Appendix F

## General Conditions Estimate

| Appendix F: General Conditions Estimate | | | | | |
|---|---|---|---|---|---|
| Item | Quantity | Amount | Unit Cost | Units | Total |
| | | **Staff** | | | |
| VP of Operations | 1 | 10.00 | $1,950.00 | /wk | $19,500.00 |
| General Superintendent | 1 | 5.00 | $1,910.00 | /wk | $9,550.00 |
| Project Manager | 1 | 70.00 | $1,620.00 | /wk | $113,400.00 |
| Project Engineer | 1 | 70.00 | $1,125.00 | /wk | $78,750.00 |
| Superintendent | 1 | 60.00 | $1,300.00 | /wk | $78,000.00 |
| Estimator | 1 | 5.00 | $1,430.00 | /wk | $7,150.00 |
| Field Engineer | 1 | 10.00 | $850.00 | /wk | $8,500.00 |
| **Total** | | | | | $314,850.00 |
| | | **General Site Work** | | | |
| Dumpster | 1 | 20.00 | $425.00 | each | $8,500.00 |
| Final Cleanup | 1 | 13300.00 | $0.10 | SF | $1,330.00 |
| Saftey Rails | 6 | 384.00 | $2.50 | LF | $5,760.00 |
| Fire Extinguisher | 5 | 1.00 | $65.00 | each | $325.00 |
| Site Fence | 1 | 720.00 | $5.00 | LF | $3,600.00 |
| **Total** | | | | | $19,515.00 |
| | | **Temporary Utilities** | | | |
| Electrical Connection | 1 | 1.00 | $3,000.00 | each | $3,000.00 |
| Electrical Monthly Rate | 1 | 76.00 | $400.00 | /wk | $30,400.00 |
| Telephone Service | 1 | 76.00 | $45.00 | /wk | $3,420.00 |
| Cell Phone | 3 | 76.00 | $60.00 | /wk | $13,680.00 |
| Water | 1 | 76.00 | $10.00 | /wk | $760.00 |
| Sanitary Facilities | 2 | 76.00 | $30.00 | /mo | $4,560.00 |
| **Total** | | | | | $55,820.00 |
| | | **Temporary Facilities** | | | |
| Computer | 2 | 76.00 | $17.00 | /wk | $2,584.00 |
| Internet | 1 | 17.00 | $50.00 | /mo | $850.00 |
| Printer / Scanenr / Fax | 1 | 1.00 | $100.00 | each | $100.00 |
| Walkie Talkies | 4 | 1.00 | $25.00 | each | $100.00 |
| Office Expenses | 1 | 76.00 | $20.00 | /wk | $1,520.00 |
| **Total** | | | | | $5,154.00 |
| | | | | | |
| **Total** | | | | | **$395,339.00** |

# Appendix H

## Hollow Core Planks

# Wm. S. LONG INC.

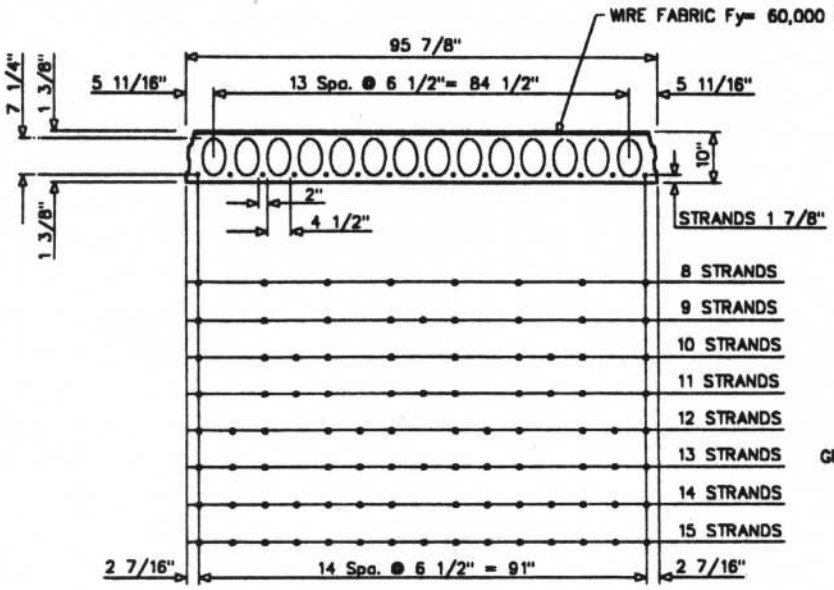
127 BREAKNECK ST.
P.O. BOX AC
CALLERY, PA. 16024

Manufacturers of Precast Prestressed Concrete

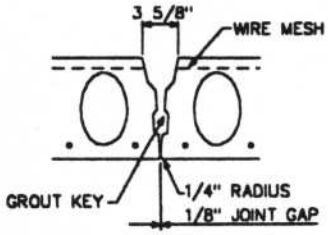
(724) 538-3775
FAX (724) 538-5588


**Dynaspan®**

8'-0" X 10" Normal Weight Concrete @ 150 PCF




**SECTION PROPERTIES**
UNTOPPED
$A=532.00\ in^2$
$I=6422\ in^4$
$Yb=4.96$ (In.)
$V/S=2.51$ (In.)
WT=554.00 PLF
69.25 PSF




TYPICAL GROUT JOINT

**Table of safe superimposed service loads ( psf )** — **No Topping**

| Number & Size of 270K Strands Per 8'-0" Width | Span, Ft. | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 8-1/2" | 183 | 162 | 143 | 127 | 112 | 99 | 88 | 77 | 68 | 60 | 52 | 45 | 39 | 34 | 28 | | | | | | |
| 9-1/2" | 211 | 187 | 166 | 148 | 132 | 117 | 105 | 93 | 83 | 74 | 65 | 58 | 51 | 44 | 38 | 33 | 28 | | | | |
| 10-1/2" | 238 | 212 | 189 | 169 | 151 | 135 | 121 | 108 | 97 | 87 | 78 | 69 | 62 | 55 | 48 | 42 | 37 | 32 | 27 | | |
| 11-1/2" | 265 | 236 | 211 | 189 | 170 | 153 | 137 | 124 | 111 | 100 | 90 | 81 | 72 | 64 | 57 | 50 | 44 | 38 | 33 | 28 | |
| 12-1/2" | 282 | 260 | 233 | 209 | 188 | 170 | 153 | 138 | 125 | 112 | 101 | 90 | 81 | 72 | 65 | 57 | 51 | 45 | 39 | 34 | 29 |
| 13-1/2" | | 267 | 252 | 228 | 205 | 185 | 166 | 150 | 135 | 122 | 110 | 99 | 89 | 80 | 72 | 64 | 57 | 51 | 45 | 39 | 34 |
| 14-1/2" | | | | 239 | 219 | 198 | 178 | 161 | 146 | 132 | 119 | 108 | 97 | 88 | 79 | 71 | 64 | 57 | 51 | 45 | 40 |
| 15-1/2" | | | | | 228 | 210 | 190 | 172 | 156 | 142 | 128 | 116 | 106 | 96 | 86 | 78 | 70 | 63 | 57 | 51 | 45 |

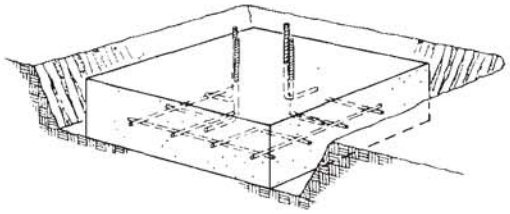
**Table of safe superimposed service loads (psf )** — **2" Normal Weight Topping**

| Number & Size of 270K Strands Per 8'-0" Width | Span, Ft. | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 8-1/2" | 223 | 196 | 172 | 152 | 134 | 118 | 103 | 89 | 74 | 61 | 49 | 39 | | | | | | | | | |
| 9-1/2" | 257 | 227 | 201 | 178 | 158 | 140 | 122 | 105 | 89 | 75 | 63 | 51 | 41 | 31 | 23 | | | | | | |
| 10-1/2" | 291 | 258 | 229 | 204 | 182 | 160 | 139 | 121 | 104 | 89 | 76 | 64 | 53 | 42 | 33 | 24 | | | | | |
| 11-1/2" | 324 | 288 | 257 | 229 | 203 | 178 | 156 | 137 | 119 | 103 | 89 | 76 | 64 | 53 | 43 | 34 | 26 | | | | |
| 12-1/2" | 348 | 318 | 284 | 251 | 222 | 196 | 173 | 152 | 134 | 117 | 102 | 88 | 75 | 64 | 53 | 44 | 35 | 27 | | | |
| 13-1/2" | | 329 | 307 | 272 | 241 | 214 | 189 | 167 | 148 | 130 | 114 | 100 | 86 | 74 | 63 | 53 | 44 | 35 | 27 | | |
| 14-1/2" | | | 311 | 292 | 260 | 231 | 205 | 182 | 162 | 143 | 126 | 111 | 97 | 85 | 73 | 62 | 53 | 44 | 35 | 28 | |
| 15-1/2" | | | | 295 | 278 | 248 | 221 | 197 | 176 | 156 | 139 | 123 | 108 | 95 | 83 | 72 | 61 | 52 | 43 | 35 | 28 |

# Appendix I

## RS Means Structural Data

## A1010 Standard Foundations



The Spread Footing System includes: excavation; backfill; forms (four uses); all reinforcement; 3,000 p.s.i. concrete (chute placed); and screed finish.

Footing systems are priced per individual unit. The Expanded System Listing at the bottom shows footings that range from 3' square x 12" deep, to 18' square x 52" deep. It is assumed that excavation is done by a truck mounted hydraulic excavator with an operator and oiler.

Backfill is with a dozer, and compaction by air tamp. The excavation and backfill equipment is assumed to operate at 30 C.Y. per hour.

Please see the reference section for further design and cost information.

| System Components | QUANTITY | UNIT | COST EACH MAT. | COST EACH INST. | COST EACH TOTAL |
|---|---|---|---|---|---|
| **SYSTEM A1010 210 7100** | | | | | |
| **SPREAD FOOTINGS, LOAD 25K, SOIL CAPACITY 3 KSF, 3' SQ X 12" DEEP** | | | | | |
| Bulk excavation | .590 | C.Y. | | 4.66 | 4.66 |
| Hand trim | 9.000 | S.F. | | 7.20 | 7.20 |
| Compacted backfill | .260 | C.Y. | | .84 | .84 |
| Formwork, 4 uses | 12.000 | S.F. | 8.40 | 52.20 | 60.60 |
| Reinforcing, fy = 60,000 psi | .006 | Ton | 5.85 | 6.45 | 12.30 |
| Dowel or anchor bolt templates | 6.000 | L.F. | 5.22 | 21.60 | 26.82 |
| Concrete, f'c = 3,000 psi | .330 | C.Y. | 36.30 | | 36.30 |
| Place concrete, direct chute | .330 | C.Y. | | 6.59 | 6.59 |
| Screed finish | 9.000 | S.F. | | 2.34 | 2.34 |
| TOTAL | | | 55.77 | 101.88 | 157.65 |

| A1010 210 | Spread Footings | | COST EACH MAT. | COST EACH INST. | COST EACH TOTAL |
|---|---|---|---|---|---|
| 7090 | Spread footings, 3000 psi concrete, chute delivered | | | | |
| 7100 | Load 25K, soil capacity 3 KSF, 3'-0" sq. x 12" deep | | 56 | 102 | 158 |
| 7150 | Load 50K, soil capacity 3 KSF, 4'-6" sq. x 12" deep | RA1010 -120 | 120 | 176 | 296 |
| 7200 | Load 50K, soil capacity 6 KSF, 3'-0" sq. x 12" deep | | 56 | 102 | 158 |
| 7250 | Load 75K, soil capacity 3 KSF, 5'-6" sq. x 13" deep | | 190 | 248 | 438 |
| 7300 | Load 75K, soil capacity 6 KSF, 4'-0" sq. x 12" deep | | 96.50 | 150 | 246.50 |
| 7350 | Load 100K, soil capacity 3 KSF, 6'-0" sq. x 14" deep | | 241 | 297 | 538 |
| 7410 | Load 100K, soil capacity 6 KSF, 4'-6" sq. x 15" deep | | 147 | 207 | 354 |
| 7450 | Load 125K, soil capacity 3 KSF, 7'-0" sq. x 17" deep | | 385 | 430 | 815 |
| 7500 | Load 125K, soil capacity 6 KSF, 5'-0" sq. x 16" deep | | 190 | 249 | 439 |
| 7550 | Load 150K, soil capacity 3 KSF, 7'-6" sq. x 18" deep | | 460 | 500 | 960 |
| 7610 | Load 150K, soil capacity 6 KSF, 5'-6" sq. x 18" deep | | 254 | 315 | 569 |
| 7650 | Load 200K, soil capacity 3 KSF, 8'-6" sq. x 20" deep | | 660 | 660 | 1,320 |
| 7700 | Load 200K, soil capacity 6 KSF, 6'-0" sq. x 20" deep | | 330 | 385 | 715 |
| 7750 | Load 300K, soil capacity 3 KSF, 10'-6" sq. x 25" deep | | 1,225 | 1,075 | 2,300 |
| 7810 | Load 300K, soil capacity 6 KSF, 7'-6" sq. x 25" deep | | 630 | 650 | 1,280 |
| 7850 | Load 400K, soil capacity 3 KSF, 12'-6" sq. x 28" deep | | 1,925 | 1,625 | 3,550 |
| 7900 | Load 400K, soil capacity 6 KSF, 8'-6" sq. x 27" deep | | 880 | 850 | 1,730 |
| 7950 | Load 500K, soil capacity 3 KSF, 14'-0" sq. x 31" deep | | 2,675 | 2,100 | 4,775 |
| 8010 | Load 500K, soil capacity 6 KSF, 9'-6" sq. x 30" deep | | 1,200 | 1,100 | 2,300 |

## B1010 208 Steel Columns

| | LOAD (KIPS) | UNSUPPORTED HEIGHT (FT.) | WEIGHT (P.L.F.) | SIZE (IN.) | TYPE | COST PER V.L.F. MAT. | INST. | TOT |
|---|---|---|---|---|---|---|---|---|
| 3200 | 100 | 20 | 40 | 8 | A | 51.50 | 7.20 | 4600 |
| 3220 | | | 28.55 | 8 | B | 36.50 | 7.20 | 4620 |
| 3240 | | | 81 | 8-5/8 | C | 38 | 7.20 | 4640 |
| 3260 | | | 25.82 | 8 | D | 33 | 7.20 | 4660 |
| 3280 | | | 66 | 7 | E | 30 | 7.20 | 4680 |
| 3300 | | | 27.59 | 8x6 | F | 35.50 | 7.20 | 4700 |
| 3320 | | | 70 | 8x6 | G | 43 | 7.20 | 4720 |
| 3400 | 125 | 10 | 31 | 8 | A | 45.50 | 9.65 | 4800 |
| 3420 | | | 28.57 | 6 | B | 42 | 9.65 | 4820 |
| 3440 | | | 81 | 8 | C | 43.50 | 9.65 | 4840 |
| 3460 | | | 22.42 | 7 | D | 33 | 9.65 | 4860 |
| 3480 | | | 49 | 6 | E | 29 | 9.65 | 4880 |
| 3500 | | | 22.42 | 8x6 | F | 33 | 9.65 | 4900 |
| 3520 | | | 64 | 8x6 | G | 34 | 9.65 | 4920 |
| 3600 | 125 | 16 | 40 | 8 | A | 54 | 7.20 | 5000 |
| 3620 | | | 28.55 | 8 | B | 38.50 | 7.20 | 5020 |
| 3640 | | | 81 | 8 | C | 40 | 7.20 | 5040 |
| 3660 | | | 25.82 | 8 | D | 35 | 7.20 | 5060 |
| 3680 | | | 66 | 7 | E | 31.50 | 7.20 | 5080 |
| 3700 | | | 27.59 | 8x6 | F | 37.50 | 7.20 | 5100 |
| 3720 | | | 64 | 8x6 | G | 31.50 | 7.20 | 5120 |
| 3800 | | 20 | 48 | 8 | A | 61.50 | 7.20 | 5200 |
| 3820 | | | 40.48 | 10 | B | 52 | 7.20 | 5220 |
| 3840 | | | 81 | 8 | C | 38 | 7.20 | 5240 |
| 3860 | | | 25.82 | 8 | D | 33 | 7.20 | 5260 |
| 3880 | | | 66 | 7 | E | 30 | 7.20 | 5280 |
| 3900 | | | 37.59 | 10x6 | F | 48 | 7.20 | 5300 |
| 3920 | | | 60 | 8x6 | G | 43 | 7.20 | 5320 |
| 4000 | 150 | 10 | 35 | 8 | A | 51 | 9.65 | 5400 |
| 4020 | | | 40.48 | 10 | B | 59.50 | 9.65 | 5420 |
| 4040 | | | 81 | 8-5/8 | C | 43.50 | 9.65 | 5440 |
| 4060 | | | 25.82 | 8 | D | 38 | 9.65 | 5460 |
| 4080 | | | 66 | 7 | E | 34 | 9.65 | 5480 |
| 4100 | | | 27.48 | 7x5 | F | 40 | 9.65 | 5500 |
| 4120 | | | 64 | 8x6 | G | 34 | 9.65 | 5600 |
| 4200 | | 16 | 45 | 10 | A | 61 | 7.20 | 5620 |
| 4220 | | | 40.48 | 10 | B | 55 | 7.20 | 5640 |
| 4240 | | | 81 | 8-5/8 | C | 40 | 7.20 | 5660 |
| 4260 | | | 31.84 | 8 | D | 43 | 7.20 | 5680 |
| 4280 | | | 66 | 7 | E | 31.50 | 7.20 | 5700 |
| 4300 | | | 37.69 | 10x6 | F | 51 | 7.20 | 5800 |
| 4320 | | | 70 | 8x6 | G | 45.50 | 7.20 | 5840 |
| 4400 | | 20 | 49 | 10 | A | 63 | 7.20 | 5860 |
| 4420 | | | 40.48 | 10 | B | 52 | 7.20 | 5880 |
| 4440 | | | 123 | 10-3/4 | C | 54.50 | 7.20 | 5900 |
| 4460 | | | 31.84 | 8 | D | 41 | 7.20 | 6000 |
| 4480 | | | 82 | 8 | E | 35 | 7.20 | 6040 |
| 4500 | | | 37.69 | 10x6 | F | 48.50 | 7.20 | 6060 |
| 4520 | | | 86 | 10x6 | G | 42.50 | 7.20 | 6080 |
| | | | | | | | | 6100 |

## B1010 Floor Construction

### B1010 214 "T" Shaped Precast Beams

| | SPAN (FT.) | SUPERIMPOSED LOAD (K.L.F.) | SIZE W X D (IN.) | BEAM WEIGHT (P.L.F.) | TOTAL LOAD (K.L.F.) | COST PER L.F. | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MAT. | INST. | TOTAL |
| 3100 | 20 | 1.46 | 12x16 | 260 | 1.72 | 143 | 13.80 | 156.80 |
| 3200 | | 2.28 | 12x20 | 355 | 2.64 | 142 | 13.80 | 155.80 |
| 3300 | | 3.28 | 12x24 | 445 | 3.73 | 166 | 14.70 | 180.70 |
| 3400 | | 4.49 | 12x28 | 515 | 5.00 | 179 | 14.70 | 193.70 |
| 3500 | | 7.32 | 12x36 | 680 | 8.00 | 203 | 15.60 | 218.60 |
| 3600 | | 11.26 | 12x44 | 840 | 12.10 | 229 | 16.55 | 245.55 |
| 3700 | | 4.70 | 18x24 | 595 | 5.30 | 182 | 14.70 | 196.70 |
| 3800 | | 6.51 | 18x28 | 690 | 7.20 | 197 | 15.60 | 212.60 |
| 3900 | | 10.7 | 18x36 | 905 | 11.61 | 225 | 16.55 | 241.55 |
| 4300 | | 16.19 | 18x44 | 1115 | 17.31 | 259 | 23 | 282 |
| 4400 | | 22.77 | 18x52 | 1330 | 24.10 | 288 | 23 | 311 |
| 4500 | | 6.15 | 24x24 | 745 | 6.90 | 201 | 15.60 | 216.60 |
| 4600 | | 8.54 | 24x28 | 865 | 9.41 | 218 | 16.55 | 234.55 |
| 4700 | | 14.17 | 24x36 | 1130 | 15.30 | 250 | 23 | 273 |
| 4800 | | 21.41 | 24x44 | 1390 | 22.80 | 286 | 23 | 309 |
| 4900 | | 30.25 | 24x52 | 1655 | 31.91 | 330 | 30.50 | 360.50 |
| 5000 | 25 | 2.68 | 12x28 | 515 | 3.2 | 181 | 11.95 | 192.95 |
| 5050 | | 4.44 | 12x36 | 680 | 5.12 | 205 | 13.80 | 218.80 |
| 5100 | | 6.90 | 12x44 | 840 | 7.74 | 233 | 18.40 | 251.40 |
| 5200 | | 9.75 | 12x52 | 1005 | 10.76 | 261 | 18.40 | 279.40 |
| 5300 | | 13.43 | 12x60 | 1165 | 14.60 | 287 | 18.40 | 305.40 |
| 5350 | | 3.92 | 18x28 | 690 | 4.61 | 200 | 13.80 | 213.80 |
| 5400 | | 6.52 | 18x36 | 905 | 7.43 | 229 | 18.40 | 247.40 |
| 5500 | | 9.96 | 18x44 | 1115 | 11.08 | 214 | 18.40 | 232.40 |
| 5600 | | 14.09 | 18x52 | 1330 | 15.42 | 298 | 25 | 323 |
| 5650 | | 19.39 | 18x60 | 1540 | 20.93 | 325 | 25 | 350 |
| 5700 | | 3.67 | 24x24 | 745 | 4.42 | 204 | 13.80 | 217.80 |
| 5750 | | 5.15 | 24x28 | 865 | 6.02 | 222 | 18.40 | 240.40 |
| 5800 | | 8.66 | 24x36 | 1130 | 9.79 | 205 | 18.40 | 223.40 |
| 5850 | | 13.20 | 24x44 | 1390 | 14.59 | 295 | 25 | 320 |
| 5900 | | 18.76 | 24x52 | 1655 | 20.42 | 330 | 25 | 355 |
| 5950 | | 25.35 | 24x60 | 1916 | 27.27 | 355 | 25 | 380 |
| 6000 | 30 | 2.88 | 12x36 | 680 | 3.56 | 208 | 15.60 | 223.60 |
| 6100 | | 4.54 | 12x44 | 840 | 5.38 | 239 | 15.60 | 254.60 |
| 6200 | | 6.46 | 12x52 | 1005 | 7.47 | 272 | 20 | 292 |
| 6250 | | 8.97 | 12x60 | 1165 | 10.14 | 296 | 20 | 316 |
| 6300 | | 4.25 | 18x36 | 905 | 5.16 | 230 | 15.60 | 245.60 |
| 6350 | | 6.57 | 18x44 | 1115 | 7.69 | 267 | 20 | 287 |
| 6400 | | 9.38 | 18x52 | 1330 | 10.71 | 295 | 20 | 315 |
| 6500 | | 13.00 | 18x60 | 1540 | 14.54 | 325 | 20 | 345 |
| 6700 | | 3.31 | 24x28 | 865 | 4.18 | 222 | 15.60 | 237.60 |
| 6750 | | 5.67 | 24x36 | 1130 | 6.80 | 259 | 20 | 279 |
| 6800 | | 8.74 | 24x44 | 1390 | 10.13 | 293 | 20 | 313 |
| 6850 | | 12.52 | 24x52 | 1655 | 14.18 | 279 | 20 | 299 |
| 6900 | | 17.00 | 24x60 | 1215 | 18.92 | 360 | 20 | 380 |

## B1010 Floor Construction

### B1010 229 Precast Plank with No Topping

| | SPAN (FT.) | SUPERIMPOSED LOAD (P.S.F.) | TOTAL DEPTH (IN.) | DEAD LOAD (P.S.F.) | TOTAL LOAD (P.S.F.) | COST PER S.F. | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MAT. | INST. | TOTAL |
| 1700 | 45 | 40 | 12 | 70 | 110 | 9.70 | 1.84 | 11.54 |

### B1010 230 Precast Plank with 2″ Concrete Topping

| | SPAN (FT.) | SUPERIMPOSED LOAD (P.S.F.) | TOTAL DEPTH (IN.) | DEAD LOAD (P.S.F.) | TOTAL LOAD (P.S.F.) | COST PER S.F. | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MAT. | INST. | TOTAL |
| 2000 | 10 | 40 | 6 | 75 | 115 | 6.80 | 5.05 | 11.85 |
| 2100 | | 75 | 8 | 75 | 150 | 8.15 | 4.61 | 12.76 |
| 2200 | | 100 | 8 | 75 | 175 | 8.15 | 4.61 | 12.76 |
| 2500 | 15 | 40 | 8 | 75 | 115 | 8.15 | 4.61 | 12.76 |
| 2600 | | 75 | 8 | 75 | 150 | 8.15 | 4.61 | 12.76 |
| 2700 | | 100 | 8 | 75 | 175 | 8.15 | 4.61 | 12.76 |
| 2800 | 20 | 40 | 8 | 75 | 115 | 8.15 | 4.61 | 12.76 |
| 2900 | | 75 | 8 | 75 | 150 | 8.15 | 4.61 | 12.76 |
| 3000 | | 100 | 8 | 75 | 175 | 8.15 | 4.61 | 12.76 |
| 3100 | 25 | 40 | 8 | 75 | 115 | 8.15 | 4.61 | 12.76 |
| 3200 | | 75 | 8 | 75 | 150 | 8.15 | 4.61 | 12.76 |
| 3300 | | 100 | 10 | 80 | 180 | 8.80 | 4.28 | 13.08 |
| 3400 | 30 | 40 | 10 | 80 | 120 | 8.80 | 4.28 | 13.08 |
| 3500 | | 75 | 10 | 80 | 155 | 8.80 | 4.28 | 13.08 |
| 3600 | | 100 | 10 | 80 | 180 | 8.80 | 4.28 | 13.08 |
| 3700 | 35 | 40 | 12 | 95 | 135 | 9.35 | 4.03 | 13.38 |
| 3800 | | 75 | 12 | 95 | 170 | 9.35 | 4.03 | 13.38 |
| 3900 | | 100 | 14 | 95 | 195 | 10.60 | 3.82 | 14.42 |
| 4000 | 40 | 40 | 12 | 95 | 135 | 9.35 | 4.03 | 13.38 |
| 4500 | | 75 | 14 | 95 | 170 | 10.60 | 3.82 | 14.42 |
| 5000 | 45 | 40 | 14 | 95 | 135 | 10.60 | 3.82 | 14.42 |

## B2010 Exterior Walls

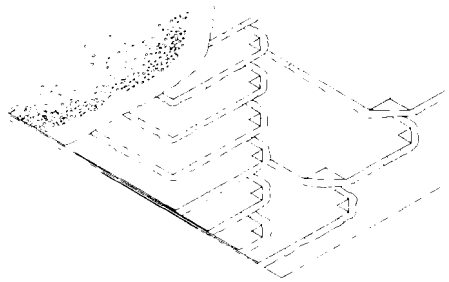
### B2010 129 Brick Veneer/Wood Stud Backup

| | FACE BRICK | STUD BACKUP | STUD SPACING (IN.) | BOND | | COST PER S.F. | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MAT. | INST. | TOTAL |
| 4500 | Norwegian | 2x6-wood | 24 | running | | 6.75 | 10.30 | 17 |
| 4520 | | | | common | | 7.65 | 11.40 | 19 |
| 4540 | | | | Flemish | | 8.25 | 13.20 | 21 |
| 4560 | | | | English | | 9.05 | 13.75 | 22 |

### B2010 130 Brick Veneer/Metal Stud Backup

| | FACE BRICK | STUD BACKUP | STUD SPACING (IN.) | BOND | | COST PER S.F. | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MAT. | INST. | TOTAL |
| 5100 | Standard | 25ga.x6"NLB | 24 | running | | 8.40 | 14.20 | 22 |
| 5120 | | | | common | | 9.70 | 16.05 | 25 |
| 5140 | | | | Flemish | | 10.25 | 18.25 | 28 |
| 5160 | | | | English | | 11.80 | 19.85 | 31 |
| 5200 | | 20ga.x3-5/8"NLB | 16 | running | | 8.55 | 14.80 | 23 |
| 5220 | | | | common | | 9.85 | 16.65 | 26 |
| 5240 | | | | Flemish | | 10.80 | 19.40 | 30 |
| 5260 | | | | English | | 11.95 | 20.50 | 32 |
| 5300 | | | 24 | running | | 8.40 | 14.35 | 22 |
| 5320 | | | | common | | 9.70 | 16.20 | 25 |
| 5340 | | | | Flemish | | 10.65 | 18.95 | 29 |
| 5360 | | | | English | | 11.80 | 20 | 31 |
| 5400 | | 16ga.x3-5/8"LB | 16 | running | | 9.35 | 15 | 24 |
| 5420 | | | | common | | 10.65 | 16.85 | 27 |
| 5440 | | | | Flemish | | 11.60 | 19.60 | 31 |
| 5460 | | | | English | | 12.75 | 20.50 | 33 |
| 5500 | | | 24 | running | | 9 | 14.60 | 23 |
| 5520 | | | | common | | 10.30 | 16.45 | 26 |
| 5540 | | | | Flemish | | 11.25 | 19.20 | 30 |
| 5560 | | | | English | | 12.40 | 20.50 | 32 |
| 5700 | Glazed | 25ga.x6"NLB | 24 | running | | 12.10 | 14.65 | 26 |
| 5720 | | | | common | | 14.20 | 16.70 | 30 |
| 5740 | | | | Flemish | | 15.60 | 19.85 | 35 |
| 5760 | | | | English | | 17.35 | 21 | 38 |
| 5800 | | 20ga.x3-5/8"NLB | 24 | running | | 12.10 | 14.80 | 26 |
| 5820 | | | | common | | 14.20 | 16.85 | 31 |
| 5840 | | | | Flemish | | 15.60 | 20 | 35 |
| 5860 | | | | English | | 17.35 | 21 | 38 |
| 6000 | | 16ga.x3-5/8"LB | 16 | running | | 13.05 | 15.45 | 28 |
| 6020 | | | | common | | 15.15 | 17.50 | 32 |
| 6040 | | | | Flemish | | 16.55 | 20.50 | 37 |
| 6060 | | | | English | | 18.30 | 22 | 40 |
| 6100 | | | 24 | running | | 12.70 | 15.05 | 27 |
| 6120 | | | | common | | 14.80 | 17.10 | 31 |
| 6140 | | | | Flemish | | 16.20 | 20.50 | 36 |
| 6160 | | | | English | | 17.95 | 21.50 | 39 |
| 6300 | Engineer | 25ga.x6"NLB | 24 | running | | 6.55 | 12.65 | 19 |
| 6320 | | | | common | | 7.45 | 14.20 | 21 |
| 6340 | | | | Flemish | | 8.10 | 16.70 | 24 |
| 6360 | | | | English | | 8.90 | 17.50 | 26 |
| 6400 | | 20ga.x3-5/8"NLB | 16 | running | | 6.65 | 13.25 | 19 |
| 6420 | | | | common | | 7.60 | 14.80 | 22 |
| 6440 | | | | Flemish | | 8.25 | 17.30 | 25 |
| 6460 | | | | English | | 9.05 | 18.10 | 27 |

# B3010 Roof Coverings

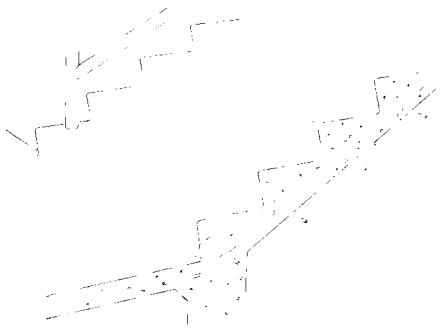


Multiple ply roofing is the most popular covering for minimum pitch roofs. Lines 1200 through 6300 list the costs of the various types, plies and weights per S.F.

| System Components | QUANTITY | UNIT | COST PER S.F. MAT. | INST. | TOTAL |
|---|---|---|---|---|---|
| SYSTEM B3010 105 2500 | | | | | |
| ASPHALT FLOOD COAT, W/GRAVEL, 4 PLY ORGANIC FELT | | | | | |
| Organic #30 base felt | 1.000 | S.F. | .05 | .08 | |
| Organic #15 felt, 3 plies | 3.000 | S.F. | .14 | .23 | |
| Asphalt mopping of felts | 4.000 | S.F. | .30 | .70 | |
| Asphalt flood coat | 1.000 | S.F. | .19 | .57 | |
| Gravel aggregate, washed river stone | 4.000 | Lb. | .07 | .13 | |
| TOTAL | | | .75 | 1.71 | |

| B3010 105 | Built-Up | COST PER S.F. MAT. | INST. | TOTAL |
|---|---|---|---|---|
| 1200 | Asphalt flood coat w/gravel; not incl. insul, flash., nailers | | | |
| 1300 | | | | |
| 1400 | Asphalt base sheets & 3 plies #15 asphalt felt, mopped | .74 | 1.55 | |
| 1500 | On nailable deck | .78 | 1.62 | |
| 1600 | 4 plies #15 asphalt felt, mopped | 1.02 | 1.70 | |
| 1700 | On nailable deck | .92 | 1.79 | |
| 1800 | Coated glass base sheet, 2 plies glass (type IV), mopped | .76 | 1.55 | |
| 1900 | For 3 plies | .90 | 1.70 | |
| 2000 | On nailable deck | .85 | 1.79 | |
| 2300 | 4 plies glass fiber felt (type IV), mopped | 1.10 | 1.70 | |
| 2400 | On nailable deck | .99 | 1.79 | |
| 2500 | Organic base sheet & 3 plies #15 organic felt, mopped | .75 | 1.71 | |
| 2600 | On nailable deck | .77 | 1.79 | |
| 2700 | 4 plies #15 organic felt, mopped | .96 | 1.55 | |
| 2750 | | | | |
| 2800 | Asphalt flood coat, smooth surface, not incl. insul, flash., nailers | | | |
| 2850 | | | | |
| 2900 | Asphalt base sheet & 3 plies #15 asphalt felt, mopped | .78 | 1.42 | |
| 3000 | On nailable deck | .73 | 1.48 | |
| 3100 | Coated glass fiber base sheet & 2 plies glass fiber felt, mopped | .70 | 1.36 | |
| 3200 | On nailable deck | .66 | 1.42 | |
| 3300 | For 3 plies, mopped | .84 | 1.48 | |
| 3400 | On nailable deck | .79 | 1.55 | |
| 3700 | 4 plies glass fiber felt (type IV), mopped | .99 | 1.48 | |
| 3800 | On nailable deck | .93 | 1.55 | |
| 3900 | Organic base sheet & 3 plies #15 organic felt, mopped | .77 | 1.42 | |
| 4000 | On nailable decks | .71 | 1.48 | |
| 4100 | 4 plies #15 organic felt, mopped | .90 | 1.55 | |
| 4200 | Coal tar pitch with gravel surfacing | | | |
| 4300 | 4 plies #15 tarred felt, mopped | 1.49 | 1.62 | |
| 4400 | 3 plies glass fiber felt (type IV), mopped | 1.22 | 1.79 | |
| 4500 | Coated glass fiber base sheets 2 plies glass fiber felt, mopped | 1.22 | 1.79 | |

## C2010 Stair Construction



**General Design:** See reference section for code requirements. Maximum height between landings is 12'; usual stair angle is 20° to 50° with 30° to 35° best. Usual relation of riser to treads is:
Riser + tread = 17.5.
2x (Riser) - tread = 25.
Riser x tread = 70 or 75.
Maximum riser height is 7" for commercial, 8-1/4" for residential.
Usual riser height is 6-1/2" to 7-1/4".
Minimum tread width is 11" for commercial and 9" for residential.

For additional information please see reference section.

**Cost Per Flight:** Table below lists the cost per flight for 4'-0" wide stairs.
Side walls are not included.
Railings are included.

| System Components | QUANTITY | UNIT | COST PER FLIGHT MAT. | INST. | TOTAL |
|---|---|---|---|---|---|
| SYSTEM C2010 110 0560 | | | | | |
| STAIRS, C.I.P. CONCRETE WITH LANDING, 12 RISERS | | | | | |
| Concrete in place, free standing stairs not incl. safety treads | 48.000 | L.F. | 292.80 | 1,647.84 | 1,940.64 |
| Concrete in place, free standing stair landing | 32.000 | S.F. | 160 | 455.68 | 615.68 |
| Stair tread C.I. abrasive 4" wide | 48.000 | L.F. | 624 | 285.60 | 909.60 |
| Industrial railing, welded, 2 rail 3'-6" high 1-1/2" pipe | 18.000 | L.F. | 468 | 187.56 | 655.56 |
| Wall railing with returns, steel pipe | 17.000 | L.F. | 238 | 177.14 | 415.14 |
| TOTAL | | | 1,782.80 | 2,753.82 | 4,536.62 |

| C2010 110 | Stairs | | COST PER FLIGHT MAT. | INST. | TOTAL |
|---|---|---|---|---|---|
| 0470 | Stairs, C.I.P. concrete, w/o landing, 12 risers, w/o nosing | RC2010 -100 | 1,000 | 2,000 | 3,000 |
| 0480 | With nosing | | 1,625 | 2,275 | 3,900 |
| 0550 | W/landing, 12 risers, w/o nosing | | 1,150 | 2,475 | 3,625 |
| 0560 | With nosing | | 1,775 | 2,775 | 4,550 |
| 0570 | 16 risers, w/o nosing | | 1,425 | 3,100 | 4,525 |
| 0580 | With nosing | | 2,250 | 3,475 | 5,725 |
| 0590 | 20 risers, w/o nosing | | 1,675 | 3,725 | 5,400 |
| 0600 | With nosing | | 2,725 | 4,200 | 6,925 |
| 0610 | 24 risers, w/o nosing | | 1,925 | 4,375 | 6,300 |
| 0620 | With nosing | | 3,175 | 4,950 | 8,125 |
| 0630 | Steel, grate type w/nosing & rails, 12 risers, w/o landing | | 4,750 | 1,050 | 5,800 |
| 0640 | With landing | | 6,200 | 1,450 | 7,650 |
| 0660 | 16 risers, with landing | | 7,775 | 1,825 | 9,600 |
| 0680 | 20 risers, with landing | | 9,350 | 2,175 | 11,525 |
| 0700 | 24 risers, with landing | | 10,900 | 2,525 | 13,425 |
| 0710 | Cement fill metal pan & picket rail, 12 risers, w/o landing | | 6,175 | 1,050 | 7,225 |
| 0720 | With landing | | 8,125 | 1,575 | 9,700 |
| 0740 | 16 risers, with landing | | 10,200 | 1,950 | 12,150 |
| 0760 | 20 risers, with landing | | 12,200 | 2,300 | 14,500 |
| 0780 | 24 risers, with landing | | 14,300 | 2,650 | 16,950 |
| 0790 | Cast iron tread & pipe rail, 12 risers, w/o landing | | 6,175 | 1,050 | 7,225 |
| 0800 | With landing | | 8,125 | 1,575 | 9,700 |
| 0820 | 16 risers, with landing | | 10,200 | 1,950 | 12,150 |
| 0840 | 20 risers, with landing | | 12,200 | 2,300 | 14,500 |
| 0860 | 24 risers, with landing | | 14,300 | 2,650 | 16,950 |
| 0870 | Pan tread & flat bar rail, pre-assembled, 12 risers, w/o landing | | 5,100 | 800 | 5,900 |
| 0880 | With landing | | 9,250 | 1,250 | 10,500 |
| 0900 | 16 risers, with landing | | 10,200 | 1,375 | 11,575 |
| 0920 | 20 risers, with landing | | 11,900 | 1,675 | 13,575 |
| 0940 | 24 risers, with landing | | 13,600 | 1,925 | 15,525 |

# Appendix J

## HVAC Calculations

# *Student Apartment Building*
# *HVAC Load Analysis*

for


## MICHAEL L. NORRIS & ASSOCIATES, INC.
## CONSULTING ENGINEERS

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Prepared By:

4-4-05

## *Air Handler #1 - TWU-1 - Summary Loads*

| Zn No | Description<br>Peak Time | Area<br>People<br>Volume | Htg.Loss<br>Htg.CFM<br>CFM/Sqft | Sen.Gain<br>Clg.CFM<br>CFM/Sqft | Lat.Gain<br>S.Exh<br>W.Exh | Htg.O.A.<br>Req.CFM<br>Act.CFM | Clg.O.A.<br>Req.CFM<br>Act.CFM |
|---|---|---|---|---|---|---|---|
| 1 | Living/Dining A | 381 | 4,672 | 5,613 | 440 | 15/P | 15/P |
| | 5pm August | 2 | 113 | 419 | 35 | 30 | 30 |
| | | 3,050 | 0.30 | 1.10 | 35 | 23 | 27 |
| 2 | Bedroom #1 A | 250 | 3,310 | 3,977 | 220 | 15/P | 15/P |
| | 5pm August | 1 | 80 | 275 | 0 | 15 | 15 |
| | | 2,000 | 0.32 | 1.10 | 0 | 16 | 18 |
| 3 | Bedroom #2 A | 250 | 4,797 | 4,175 | 220 | 15/P | 15/P |
| | 5pm August | 1 | 116 | 275 | 0 | 15 | 15 |
| | | 2,000 | 0.46 | 1.10 | 0 | 23 | 18 |
| 4 | Hall/Bathrooms A | 228 | 1,626 | 2,643 | 0 | 15/P | 15/P |
| | 9pm July | 0 | 39 | 126 | 35 | 0 | 0 |
| | | 1,824 | 0.17 | 0.55 | 35 | 8 | 8 |
| | Zone Peak Totals: | 1,109 | 14,405 | 16,408 | 880 | | |
| | Total Zones: 4 | 4 | 348 | 1,095 | 70 | 60 | 60 |
| | Unique Zones: 4 | 8,874 | 0.31 | 0.99 | 70 | 70 | 70 |

# *Air Handler #1 - TWU-1 - Total Load Summary*

Air Handler Description: TWU-1 Constant Volume - Sum of Peaks
Sensible Heat Ratio: 0.96 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 5pm in July.
Outdoor Conditions: 88° DB, 72° WB, 97.98 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in August at 5pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 16,214.

Summer: Exhaust controls outside air, ----- Winter: Exhaust controls outside air.

| | | | | | |
|---|---|---|---|---|---|
| Zone Space sensible loss: | 14,405 | Btuh | | | |
| Infiltration sensible loss: | 0 | Btuh | 0 | CFM | |
| Outside Air sensible loss: | 5,796 | Btuh | 70 | CFM | |
| Supply Duct sensible loss: | 0 | Btuh | | | |
| Return Duct sensible loss: | 0 | Btuh | | | |
| Return Plenum sensible loss: | 0 | Btuh | | | |
| Total System sensible loss: | | | | | 20,201 Btuh |
| Heating Supply Air: 14,405 / (.958 X 1.08 X 40) = | | | 348 | CFM | |
| Winter Vent Outside Air (20.1% of supply) = | | | 70 | CFM | |
| Zone space sensible gain: | 16,064 | Btuh | | | |
| Infiltration sensible gain: | 0 | Btuh | | | |
| Draw-thru fan sensible gain: | 0 | Btuh | | | |
| Supply duct sensible gain: | 0 | Btuh | | | |
| Reserve sensible gain: | 6,799 | Btuh | | | |
| Total sensible gain on supply side of coil: | | | | | 22,862 Btuh |
| Cooling Supply Air: 23,013 / (.958 X 1.1 X 20) = | | | 1,096 | CFM | |
| Summer Vent Outside Air (6.4% of supply) = | | | 70 | CFM | |
| Return duct sensible gain: | 0 | Btuh | | | |
| Return plenum sensible gain: | 0 | Btuh | | | |
| Outside air sensible gain: | 1,181 | Btuh | 70 | CFM | |
| Blow-thru fan sensible gain: | 0 | Btuh | | | |
| Total sensible gain on return side of coil: | | | | | 1,181 Btuh |
| Total sensible gain on air handling system: | | | | | 24,043 Btuh |
| Zone space latent gain: | 880 | Btuh | | | |
| Infiltration latent gain: | 0 | Btuh | | | |
| Outside air latent gain: | 1,780 | Btuh | | | |
| Total latent gain on air handling system: | | | | | 2,660 Btuh |
| Total system sensible and latent gain: | | | | | 26,703 Btuh |

## Check Figures

| | | |
|---|---|---|
| Total Air Handler Supply Air (based on a 20° TD): | 1,096 | CFM |
| Total Air Handler Vent. Air (6.39% of Supply): | 70 | CFM |
| Total Conditioned Air Space: | 1,109 | Sq.ft |
| Supply Air Per Unit Area: | 0.9880 | CFM/Sq.ft |
| Area Per Cooling Capacity: | 498.4786 | Sq.ft/Ton |
| Cooling Capacity Per Area: | 0.0020 | Tons/Sq.ft |
| Total Heating Required With Outside Air: | 20,201 | Btuh |
| Total Cooling Required With Outside Air: | 2.23 | Tons |

## *Air Handler #2 - TWU-2 - Summary Loads*

| Zn No | Description<br>Peak Time | Area<br>People<br>Volume | Htg.Loss<br>Htg.CFM<br>CFM/Sqft | Sen.Gain<br>Clg.CFM<br>CFM/Sqft | Lat.Gain<br>S.Exh<br>W.Exh | Htg.O.A.<br>Req.CFM<br>Act.CFM | Clg.O.A.<br>Req.CFM<br>Act.CFM |
|---|---|---|---|---|---|---|---|
| 5 | Living/Dining B | 381 | 5,416 | 5,781 | 440 | 15/P | 15/P |
| | 5pm August | 2 | 131 | 419 | 35 | 30 | 30 |
| | | 3,050 | 0.34 | 1.10 | 35 | 26 | 27 |
| 6 | Bedroom #1 B | 250 | 3,310 | 3,977 | 220 | 15/P | 15/P |
| | 5pm August | 1 | 80 | 275 | 0 | 15 | 15 |
| | | 2,000 | 0.32 | 1.10 | 0 | 16 | 18 |
| 7 | Bedroom #2 B | 250 | 4,054 | 4,076 | 220 | 15/P | 15/P |
| | 5pm August | 1 | 98 | 275 | 0 | 15 | 15 |
| | | 2,000 | 0.39 | 1.10 | 0 | 20 | 18 |
| 8 | Hall/Bathrooms B | 228 | 1,626 | 2,643 | 0 | 15/P | 15/P |
| | 9pm July | 0 | 39 | 126 | 35 | 0 | 0 |
| | | 1,824 | 0.17 | 0.55 | 35 | 8 | 8 |
| | Zone Peak Totals: | 1,109 | 14,405 | 16,478 | 880 | | |
| | Total Zones: 4 | 4 | 348 | 1,095 | 70 | 60 | 60 |
| | Unique Zones: 4 | 8,874 | 0.31 | 0.99 | 70 | 70 | 70 |

# *Air Handler #2 - TWU-2 - Total Load Summary*

Air Handler Description: TWU-2 Constant Volume - Sum of Peaks
Sensible Heat Ratio: 0.96 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 5pm in July.
Outdoor Conditions: 88° DB, 72° WB, 97.98 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in August at 5pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 16,284.

Summer: Exhaust controls outside air, ----- Winter: Exhaust controls outside air.

| | | | | | |
|---|---|---|---|---|---|
| Zone Space sensible loss: | 14,405 | Btuh | | | |
| Infiltration sensible loss: | 0 | Btuh | 0 | CFM | |
| Outside Air sensible loss: | 5,796 | Btuh | 70 | CFM | |
| Supply Duct sensible loss: | 0 | Btuh | | | |
| Return Duct sensible loss: | 0 | Btuh | | | |
| Return Plenum sensible loss: | 0 | Btuh | | | |
| Total System sensible loss: | | | | | 20,201 Btuh |
| Heating Supply Air: 14,405 / (.958 X 1.08 X 40) = | | | 348 | CFM | |
| Winter Vent Outside Air (20.1% of supply) = | | | 70 | CFM | |
| Zone space sensible gain: | 16,133 | Btuh | | | |
| Infiltration sensible gain: | 0 | Btuh | | | |
| Draw-thru fan sensible gain: | 0 | Btuh | | | |
| Supply duct sensible gain: | 0 | Btuh | | | |
| Reserve sensible gain: | 6,730 | Btuh | | | |
| Total sensible gain on supply side of coil: | | | | | 22,863 Btuh |
| Cooling Supply Air: 23,013 / (.958 X 1.1 X 20) = | | | 1,096 | CFM | |
| Summer Vent Outside Air (6.4% of supply) = | | | 70 | CFM | |
| Return duct sensible gain: | 0 | Btuh | | | |
| Return plenum sensible gain: | 0 | Btuh | | | |
| Outside air sensible gain: | 1,181 | Btuh | 70 | CFM | |
| Blow-thru fan sensible gain: | 0 | Btuh | | | |
| Total sensible gain on return side of coil: | | | | | 1,181 Btuh |
| Total sensible gain on air handling system: | | | | | 24,043 Btuh |
| Zone space latent gain: | 880 | Btuh | | | |
| Infiltration latent gain: | 0 | Btuh | | | |
| Outside air latent gain: | 1,780 | Btuh | | | |
| Total latent gain on air handling system: | | | | | 2,660 Btuh |
| Total system sensible and latent gain: | | | | | 26,704 Btuh |

## Check Figures

| | | |
|---|---|---|
| Total Air Handler Supply Air (based on a 20° TD): | 1,096 | CFM |
| Total Air Handler Vent. Air (6.39% of Supply): | 70 | CFM |
| Total Conditioned Air Space: | 1,109 | Sq.ft |
| Supply Air Per Unit Area: | 0.9880 | CFM/Sq.ft |
| Area Per Cooling Capacity: | 498.4729 | Sq.ft/Ton |
| Cooling Capacity Per Area: | 0.0020 | Tons/Sq.ft |
| Total Heating Required With Outside Air: | 20,201 | Btuh |
| Total Cooling Required With Outside Air: | 2.23 | Tons |

## *Air Handler #3 - TWU-3 - Summary Loads*

| Zn No | Description<br>Peak Time | Area<br>People<br>Volume | Htg.Loss<br>Htg.CFM<br>CFM/Sqft | Sen.Gain<br>Clg.CFM<br>CFM/Sqft | Lat.Gain<br>S.Exh<br>W.Exh | Htg.O.A.<br>Req.CFM<br>Act.CFM | Clg.O.A.<br>Req.CFM<br>Act.CFM |
|---|---|---|---|---|---|---|---|
| 9 | Living/Dining C | 265 | 4,151 | 4,401 | 440 | 15/P | 15/P |
| | 5pm August | 2 | 100 | 291 | 35 | 30 | 30 |
| | | 2,116 | 0.38 | 1.10 | 35 | 26 | 31 |
| 10 | Bedroom C | 250 | 4,730 | 4,166 | 220 | 15/P | 15/P |
| | 5pm August | 1 | 114 | 275 | 0 | 15 | 15 |
| | | 2,000 | 0.46 | 1.10 | 0 | 30 | 30 |
| 11 | Hall/Bathroom C | 132 | 2,279 | 1,779 | 0 | 15/P | 15/P |
| | 10pm July | 0 | 55 | 84 | 35 | 0 | 0 |
| | | 1,056 | 0.42 | 0.64 | 35 | 14 | 9 |
| | Zone Peak Totals: | 647 | 11,159 | 10,346 | 660 | | |
| | Total Zones: 3 | 3 | 270 | 650 | 70 | 45 | 45 |
| | Unique Zones: 3 | 5,172 | 0.42 | 1.01 | 70 | 70 | 70 |

# *Air Handler #3 - TWU-3 - Total Load Summary*

Air Handler Description: TWU-3 Constant Volume - Sum of Peaks
Sensible Heat Ratio: 0.95 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 5pm in July.
Outdoor Conditions: 88° DB, 72° WB, 97.98 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in August at 5pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 10,083.

Summer: Exhaust controls outside air, ----- Winter: Exhaust controls outside air.

| | | | | | |
|---|---|---|---|---|---|
| Zone Space sensible loss: | 11,159 | Btuh | | | |
| Infiltration sensible loss: | 0 | Btuh | 0 | CFM | |
| Outside Air sensible loss: | 5,796 | Btuh | 70 | CFM | |
| Supply Duct sensible loss: | 0 | Btuh | | | |
| Return Duct sensible loss: | 0 | Btuh | | | |
| Return Plenum sensible loss: | 0 | Btuh | | | |
| Total System sensible loss: | | | | | 16,955 Btuh |
| Heating Supply Air: 11,159 / (.958 X 1.08 X 40) = | | | 270 | CFM | |
| Winter Vent Outside Air (26.0% of supply) = | | | 70 | CFM | |
| Zone space sensible gain: | 10,043 | Btuh | | | |
| Infiltration sensible gain: | 0 | Btuh | | | |
| Draw-thru fan sensible gain: | 0 | Btuh | | | |
| Supply duct sensible gain: | 0 | Btuh | | | |
| Reserve sensible gain: | 3,679 | Btuh | | | |
| Total sensible gain on supply side of coil: | | | | | 13,722 Btuh |
| Cooling Supply Air: 13,761 / (.958 X 1.1 X 20) = | | | 650 | CFM | |
| Summer Vent Outside Air (10.8% of supply) = | | | 70 | CFM | |
| Return duct sensible gain: | 0 | Btuh | | | |
| Return plenum sensible gain: | 0 | Btuh | | | |
| Outside air sensible gain: | 1,181 | Btuh | 70 | CFM | |
| Blow-thru fan sensible gain: | 0 | Btuh | | | |
| Total sensible gain on return side of coil: | | | | | 1,181 Btuh |
| Total sensible gain on air handling system: | | | | | 14,902 Btuh |
| Zone space latent gain: | 660 | Btuh | | | |
| Infiltration latent gain: | 0 | Btuh | | | |
| Outside air latent gain: | 1,780 | Btuh | | | |
| Total latent gain on air handling system: | | | | | 2,440 Btuh |
| Total system sensible and latent gain: | | | | | 17,343 Btuh |

## Check Figures

| | | |
|---|---|---|
| Total Air Handler Supply Air (based on a 20° TD): | 650 | CFM |
| Total Air Handler Vent. Air (10.76% of Supply): | 70 | CFM |
| Total Conditioned Air Space: | 647 | Sq.ft |
| Supply Air Per Unit Area: | 1.0060 | CFM/Sq.ft |
| Area Per Cooling Capacity: | 447.3372 | Sq.ft/Ton |
| Cooling Capacity Per Area: | 0.0022 | Tons/Sq.ft |
| Total Heating Required With Outside Air: | 16,955 | Btuh |
| Total Cooling Required With Outside Air: | 1.45 | Tons |

# Air System #1 (TWU-1) Psychrometric Analysis

| System Load Analysis | Latent | Grains | Sensible | Temp | CFM |
|---|---|---|---|---|---|
| Leaving Coil Condition | | 57.235 | | 52.079 | |
| Draw-Thru Fan | | | 0 | 0.000 | 0 |
| Misc Load on Supply Side | | | 0 | 0.000 | 0 |
| Supply Air Duct | | | 0 | 0.000 | 0 |
| Zone Loads | 880 | 1.232 | 16,214 | 14.035 | 772 |
| Sensible Reserve | | | 6,799 | 5.885 | 324 |
| Zone Condition | 880 | 58.467 | 23,013 | 72.000 | 1,096 |
| Return Air Duct | | | 0 | 0.000 | |
| Return Air Plenum | | | 0 | 0.000 | |
| Misc Load on Return Side | | | 0 | 0.000 | |
| Vent Air 70 CFM | 1,780 | 2.493 | 1,181 | 1.022 | |
| Blow-Thru Fan | | | 0 | 0.000 | |
| Entering Coil Condition | 2,660 | 60.960 | 24,194 | 73.022 | 1,096 |

## General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSH | = | 0.958 | x | 1.10 | x | 1,096 | x ( | 73.022 | - | 52.079 | ) = | 24,194 Btuh |
| TLH | = | 0.958 | x | 0.68 | x | 1,096 | x ( | 60.960 | - | 57.235 | ) = | 2,660 Btuh |
| SUM | = | | | | | | | | | | | 26,854 Btuh |
| GTH | = | 0.958 | x | 4.50 | x | 1,096 | x ( | 27.049 | - | 21.365 | ) = | 26,863 Btuh |
| Total System Load | | | | | | | | | | | = | 26,703 Btuh |

## Chilled and Hot Water Flow Rates and Steam Requirement

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cooling GPM | = | 26,863 | / ( | 0.00 | x | 500 | ) | = 0.0 GPM |
| Heating GPM | = | 20,201 | / ( | 0.00 | x | 500 | ) | = 0.0 GPM |
| Steam Req. | = | 20,201 | / | 970 | | | | = 20.8 lb./hr |

## Entering Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 73.02 | |
| Wet bulb temperature: | 60.26 | |
| Relative humidity: | 48.32 | |
| Enthalpy: | 27.05 | Btu/lbm |

## Entering Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 53.91 |

## Leaving Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 52.08 | |
| Wet bulb temperature: | 51.28 | |
| Relative humidity: | 95.00 | |
| Enthalpy: | 21.36 | Btu/lbm |

## Leaving Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 110.00 |

# Air System #2 (TWU-2) Psychrometric Analysis

| System Load Analysis | Latent | Grains | Sensible | Temp | CFM |
|---|---|---|---|---|---|
| Leaving Coil Condition | | 57.235 | | 52.079 | |
| Draw-Thru Fan | | | 0 | 0.000 | 0 |
| Misc Load on Supply Side | | | 0 | 0.000 | 0 |
| Supply Air Duct | | | 0 | 0.000 | 0 |
| Zone Loads | 880 | 1.232 | 16,284 | 14.095 | 775 |
| Sensible Reserve | | | 6,730 | 5.825 | 320 |
| Zone Condition | 880 | 58.467 | 23,013 | 72.000 | 1,096 |
| Return Air Duct | | | 0 | 0.000 | |
| Return Air Plenum | | | 0 | 0.000 | |
| Misc Load on Return Side | | | 0 | 0.000 | |
| Vent Air 70 CFM | 1,780 | 2.492 | 1,181 | 1.022 | |
| Blow-Thru Fan | | | 0 | 0.000 | |
| Entering Coil Condition | 2,660 | 60.960 | 24,194 | 73.022 | 1,096 |

## General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSH | = | 0.958 | x | 1.10 | x | 1,096 | x ( | 73.022 | - | 52.079 | ) = | 24,194 | Btuh |
| TLH | = | 0.958 | x | 0.68 | x | 1,096 | x ( | 60.960 | - | 57.235 | ) = | 2,660 | Btuh |
| SUM | = | | | | | | | | | | | 26,854 | Btuh |
| GTH | = | 0.958 | x | 4.50 | x | 1,096 | x ( | 27.049 | - | 21.365 | ) = | 26,864 | Btuh |
| Total System Load | | | | | | | | | | | = | 26,704 | Btuh |

## Chilled and Hot Water Flow Rates and Steam Requirement

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cooling GPM | = | 26,864 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Heating GPM | = | 20,201 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Steam Req. | = | 20,201 | / | 970 | | | | = | 20.8 lb./hr |

## Entering Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 73.02 | |
| Wet bulb temperature: | 60.26 | |
| Relative humidity: | 48.32 | |
| Enthalpy: | 27.05 | Btu/lbm |

## Entering Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 53.91 |

## Leaving Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 52.08 | |
| Wet bulb temperature: | 51.28 | |
| Relative humidity: | 95.00 | |
| Enthalpy: | 21.36 | Btu/lbm |

## Leaving Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 110.00 |

# Air System #3 (TWU-3) Psychrometric Analysis

| System Load Analysis | Latent | Grains | Sensible | Temp | CFM |
|---|---|---|---|---|---|
| Leaving Coil Condition | | 56.911 | | 51.927 | |
| Draw-Thru Fan | | | 0 | 0.000 | 0 |
| Misc Load on Supply Side | | | 0 | 0.000 | 0 |
| Supply Air Duct | | | 0 | 0.000 | 0 |
| Zone Loads | 660 | 1.557 | 10,083 | 14.707 | 477 |
| Sensible Reserve | | | 3,679 | 5.366 | 174 |
| Zone Condition | 660 | 58.468 | 13,761 | 72.000 | 650 |
| Return Air Duct | | | 0 | 0.000 | |
| Return Air Plenum | | | 0 | 0.000 | |
| Misc Load on Return Side | | | 0 | 0.000 | |
| Vent Air 70 CFM | 1,780 | 4.200 | 1,181 | 1.722 | |
| Blow-Thru Fan | | | 0 | 0.000 | |
| Entering Coil Condition | 2,440 | 62.668 | 14,942 | 73.722 | 650 |

## General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSH | = | 0.958 | x | 1.10 | x | 650 | x ( | 73.722 | - | 51.927 | ) = | 14,942 | Btuh |
| TLH | = | 0.958 | x | 0.68 | x | 650 | x ( | 62.668 | - | 56.911 | ) = | 2,440 | Btuh |
| SUM | = | | | | | | | | | | | 17,382 | Btuh |
| GTH | = | 0.958 | x | 4.50 | x | 650 | x ( | 27.487 | - | 21.278 | ) = | 17,414 | Btuh |
| Total System Load | | | | | | | | | | | = | 17,343 | Btuh |

## Chilled and Hot Water Flow Rates and Steam Requirement

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cooling GPM | = | 17,414 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Heating GPM | = | 16,955 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Steam Req. | = | 16,955 | / | 970 | | | | = | 17.5 lb./hr |

## Entering Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 73.72 | |
| Wet bulb temperature: | 60.89 | |
| Relative humidity: | 48.51 | |
| Enthalpy: | 27.49 | Btu/lbm |

## Entering Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 49.23 |

## Leaving Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 51.93 | |
| Wet bulb temperature: | 51.13 | |
| Relative humidity: | 95.00 | |
| Enthalpy: | 21.28 | Btu/lbm |

## Leaving Heating Coil Conditions

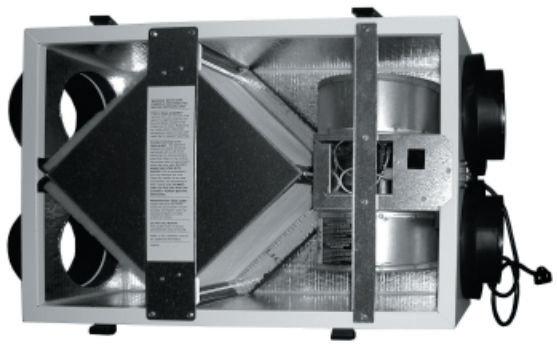
| | |
|---|---|
| Dry bulb temperature: | 110.00 |

# Appendix K

## EV70 Specifications

# EV70

## Indoor Unit



## G4 Performance

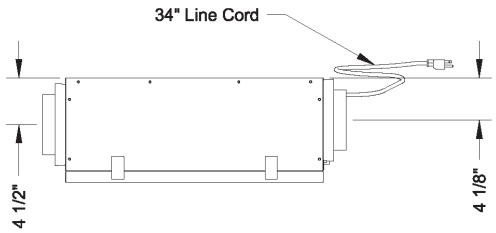
| Airflow CFM | ESP in H20 | Temp EFF% | Total EFF% Winter/Summer* |
|---|---|---|---|
| 46 | 0.40 | 81 | 74/60 |
| 59 | 0.30 | 78 | 71/57 |
| 69 | 0.25 | 75 | 69/54 |
| 73 | 0.20 | 74 | 68/53 |
| 86 | 0.10 | 71 | 64/49 |

* (See HVI certification report on page 11 for complete certified rating).

## Specifications

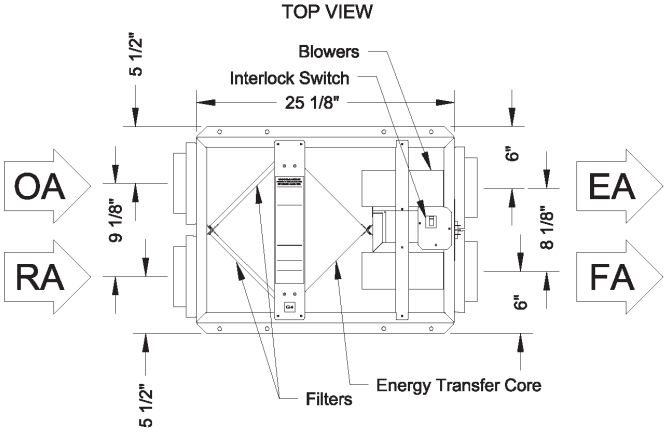
| | | | | |
|---|---|---|---|---|
| Ventilation Type: Static Plate, Heat and Humidity Transfer | | | | |
| Typical Airflow Range: 40-70 CFM | | | | |
| Unit may be mounted in any orientation. | | | | |
| Number Motors: One, 0.1 hp | | | | |
| V | HZ | Phase | Input Watts | FLA |
| 120 | 60 | Single | 94 @ 69 CFM | 1.0 |
| Control Voltage: 24 VAC | | | | |
| Filters: Cleanable, spun polyester media. 7 1/2" x 10 1/2" x 1" | | | | |
| Weight: 44 lbs (unit), 52 lbs (in carton) | | | | |
| Shipping Dimensions: 21" W x 29 1/2" L x 15" H | | | | |
| Options: PT - Percentage timer control<br>PB - Push Button point-of-use controls<br>FM - Percentage timer control with furnace interlock<br>DH24 - Dehumidistat control<br>Wall caps | | | | |

## Dimensions

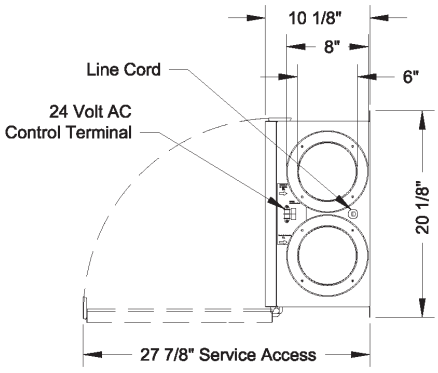



TOP VIEW

EA: Exhaust Air to outdoors
OA: Outdoor Air intake
RA: Room Air to be exhausted
FA: Fresh Air to inside




FRONT VIEW




RIGHT VIEW

RenewAire
Energy Recovery Ventilators

# SOUND GEOTHERMAL CORPORATION
## ENERGY ANALYSIS
## Kyle Macht 900 ^ft. Dorm
## 4/7/2008

### Heating Calculations

F= HL x 24 x DD / E x P x T.D.

Tons: 1.5
City: State College, PA

| | |
|---|---|
| 18,000 | HL - Design heating load in BTU |
| 6,160 | DD - Degree Days |
| 0.90 | E - Seasonal Efficiency Gas |
| 0.85 | E - Seasonal Efficiency Propane |
| 0.80 | E - Seasonal Efficiency Fuel Oil |
| 1.00 | E - Seasonal Efficiency Electricity |
| 3.40 | E - Seasonal Efficiency HP (COP) |
| 70 | Winter Setpoint (Deg. F) |
| 7 | Winter Design Temperature |
| 63 | T.D. - Design Temp. difference |

| Annual Fuel Consumption | |
|---|---|
| 45,788.62 | Gas(cubic feet) |
| 543.11 | Propane (gal) |
| 382.61 | Fuel Oil (gal) |
| 12,376.21 | Electricity (kW) |
| 3,640.06 | GSHP (kW) |

| P - Heating value of Fuel | | Annual Cost | | Fuel Cost | |
|---|---|---|---|---|---|
| 1,025 | Gas - BTU/cubic Foot | $ 434.99 | Gas | $ 0.950 | Term |
| 91,500 | Propane - gallon | $ 1,629.86 | Propane | $ 3.001 | gal. |
| 138,000 | Fuel Oil - gallon | $ 1,446.26 | Fuel Oil | $ 3.780 | gal. |
| 3,413 | Electricity - BTU/kWh | $ 1,113.86 | Electricity | $ 0.090 | kW |
| | | $ 327.61 | GSHP | | |

### Cooling Calculations

Cooling kW/year= CLH*QC / 1000*SEER

Tons: 0.75
City: State College, PA

| | |
|---|---|
| 9,000 | QC - Design Cooling Load |
| 2,523 | CLH - Cooling Degree Days |
| 11.00 | SEER - Seasonal Efficiency - AC |
| 17.50 | SEER - Seasonal Efficiency of GSHP |
| y | Heat Pump (y or n) |

| | |
|---|---|
| Cooling kW/year= | 2,064 |
| GSHP Cooling $$/yr= | 1,298 |
| $$/year= | $ 185.78 |
| GSHP $$/Year= | $ 116.78 |

### TOTAL ESTIMATED BUILDING FUEL COST

| HVAC Fuel | Conventional |
|---|---|
| Electricity | $ 1,300 |
| Propane + Electricity | $ 1,816 |
| Gas + Electricity | $ 621 |
| Fuel oil + Electricity | $ 1,632 |

| | | |
|---|---|---|
| Renewaire Size | 70 | |
| Effectivness | 0.8 | |
| Air Changes/hour | 0.33 | |
| Home Sq. Footage | 900 | Sq. Ft |
| Ceiling Height | 8 | Feet |

Estimated Energy Savings With RenewAire 163.88

# SOUND GEOTHERMAL, INC.

**Ground Source Heat Pumps * Commercial / Residential * Forced Air / Radiant *
Process Applications Consulting / Loop Design * Distribution / Dealer Support
IGSHPA Certified Installer Training *** Member IGSHPA / GHPC
Web Site: soundgt.com e-mail: soundgt@soundgt.com
3962 Alpine Valley Circle, Sandy UT 84092 801-942-6100 801-942-6127 (fax)**


## DEALER QUOTE

**Dealer: Kyle Macht**

**Project Name:**
**Freight Address:**

**Loop Type:**
**Date: 4/8/2008**

| Product | Qty | Description | Dealer Cost | Dealer Total |
|---|---|---|---|---|
| EV70 | 1 | RenewAire Energy Recovery Ventilator | $ 567.00 | $ 567.00 |

**ESTIMATED FREIGHT: $ 128.80**

**See Terms & Conditions Page.**

**Customer is responsible for all taxes!**

**Total: $ 695.80**

**Approved by: Kyle Macht**

**Date**

**Please note: This order may contain NON STOCK items. We must have your signature verifying accuracy of the above before this order can be placed. See Terms and Conditions Page!**

# Appendix L

## Trane Heat Pumps

TRANE®

# High Efficiency Horizontal & Vertical Water Source Comfort System

# Axiom™ 1/2 - 5 Tons — 60 Hz
# Model GEH/GEV

June 2007

WSHP-PRC001-EN

# Introduction

Imagine a full range of comfort utilizing efficiency, sound attenuation, integrated controls, and superior maintenance accessibility... Trane imagined it, and designed an advanced mechanical system.

Introducing models GEH and GEV water source comfort solutions.

Model GEH (pictured below) is a ceiling hung product that provides a sleek, innovative shape, along with convertibility of the supply-air and the return-air arrangement; serviceability to maintenance components; indoor air quality standards; sound attenuation; and best of all, higher efficiencies with certified ARI-ISO 13256-1 performance and ASHRAE 90.1 standards.

**Trane's new design incorporates system advantages such as:**

1. Maximum return-air and supply-air flexibility
2. Superior maintenance accessibility
3. Dual-sloped, plastic drain pan
4. Multi-speed motor
5. Insulated enclosure for quiet unit design
6. Integrated controls
7. Orifice ring motor mounting device as standard for ease of motor service
8. High and low pressure safeties as standard
9. Internal air-to-refrigerant coil (horizontal design)

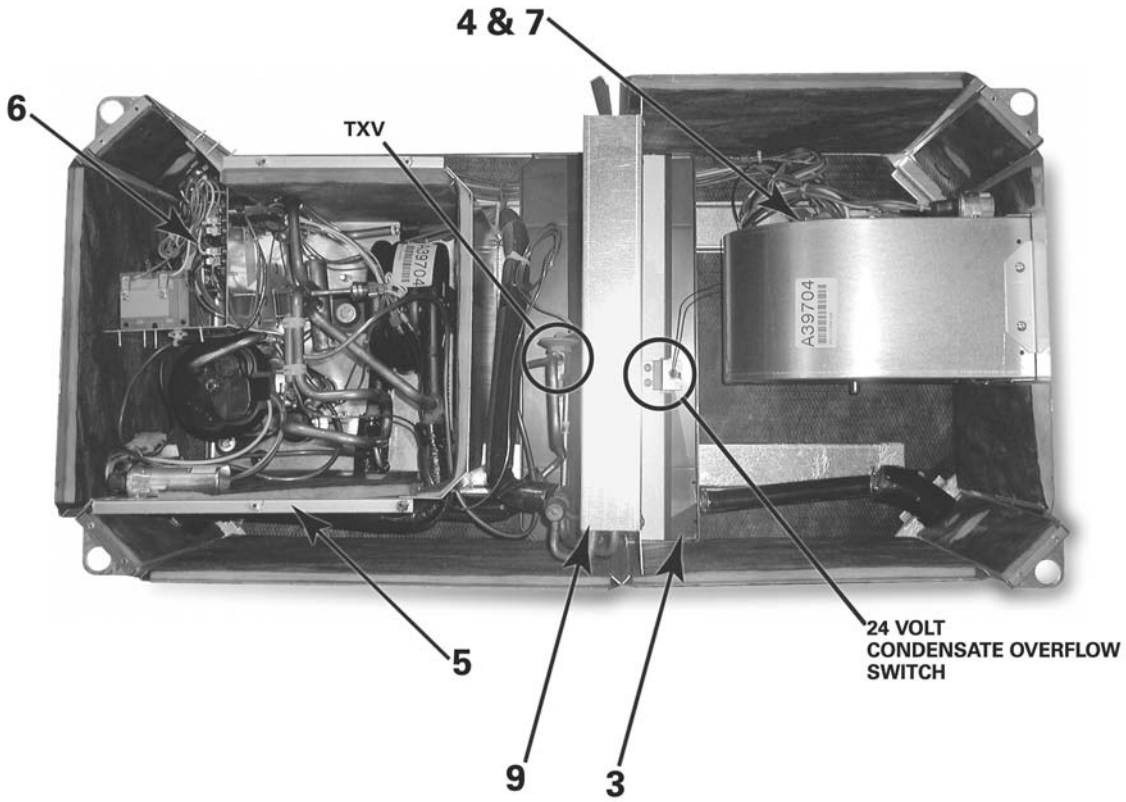


**Table 23. GEH/GEV 018 Cooling Performance**

| EWT | GPM | Total Mbtuh | Sen Mbtuh | SHR | Power kW | Reject Mouth | LWT | Feet Head |
|---|---|---|---|---|---|---|---|---|
| 45 | 2.7 | 23.87 | 16.44 | 0.69 | 1.14 | 27.77 | 65.20 | 3 |
| 45 | 3.3 | 24.20 | 16.62 | 0.69 | 1.11 | 27.99 | 61.70 | 4.3 |
| 45 | 3.7 | 24.32 | 16.67 | 0.69 | 1.09 | 28.04 | 59.93 | 5.3 |
| 45 | 4.2 | 24.47 | 16.75 | 0.68 | 1.08 | 28.15 | 58.23 | 6.6 |
| 45 | 4.4 | 24.56 | 16.86 | 0.69 | 1.07 | 28.22 | 57.64 | 7.2 |
| 45 | 4.6 | 24.59 | 16.80 | 0.68 | 1.07 | 28.22 | 57.08 | 7.7 |
| 45 | 5 | 24.69 | 16.89 | 0.68 | 1.06 | 28.29 | 56.12 | 9 |
| 55 | 2.7 | 22.87 | 16.03 | 0.70 | 1.26 | 27.19 | 74.69 | 2.9 |
| 55 | 3.3 | 23.18 | 16.19 | 0.70 | 1.23 | 27.36 | 71.25 | 4.1 |
| 55 | 3.7 | 23.33 | 16.24 | 0.70 | 1.21 | 27.45 | 69.55 | 5.1 |
| 55 | 4.2 | 23.47 | 16.28 | 0.69 | 1.19 | 27.53 | 67.87 | 6.3 |
| 55 | 4.4 | 23.56 | 16.31 | 0.69 | 1.19 | 27.61 | 67.31 | 6.9 |
| 55 | 4.6 | 23.57 | 16.35 | 0.69 | 1.18 | 27.59 | 66.78 | 7.5 |
| 55 | 5 | 23.64 | 16.36 | 0.69 | 1.17 | 27.63 | 65.86 | 8.6 |
| 68 | 2.7 | 21.43 | 15.44 | 0.72 | 1.41 | 26.23 | 86.86 | 2.8 |
| 68 | 3.3 | 21.73 | 15.59 | 0.72 | 1.37 | 26.42 | 83.58 | 4 |
| 68 | 3.7 | 21.88 | 15.65 | 0.72 | 1.36 | 26.52 | 81.96 | 4.8 |
| 68 | 4.2 | 22.03 | 15.71 | 0.71 | 1.34 | 26.61 | 80.36 | 6.1 |
| 68 | 4.4 | 22.07 | 15.73 | 0.71 | 1.34 | 26.64 | 79.80 | 6.6 |
| 68 | 4.6 | 22.11 | 15.74 | 0.71 | 1.33 | 26.66 | 79.31 | 7.1 |
| 68 | 5 | 22.19 | 15.77 | 0.71 | 1.33 | 26.71 | 78.42 | 8.3 |
| 77 | 2.7 | 20.39 | 15.02 | 0.74 | 1.50 | 25.51 | 95.24 | 2.7 |
| 77 | 3.3 | 20.67 | 15.14 | 0.73 | 1.47 | 25.69 | 92.06 | 3.8 |
| 77 | 3.7 | 20.81 | 15.20 | 0.73 | 1.46 | 25.78 | 90.49 | 4.7 |
| 77 | 4.2 | 20.93 | 15.24 | 0.73 | 1.44 | 25.86 | 88.93 | 5.9 |
| 77 | 4.4 | 20.99 | 15.27 | 0.73 | 1.44 | 25.90 | 88.41 | 6.4 |
| 77 | 4.6 | 21.02 | 15.28 | 0.73 | 1.43 | 25.91 | 87.92 | 6.9 |
| 77 | 5 | 21.10 | 15.32 | 0.73 | 1.43 | 25.97 | 87.08 | 8 |
| 86 | 2.7 | 19.29 | 14.56 | 0.75 | 1.59 | 24.73 | 103.55 | 2.6 |
| 86 | 3.3 | 19.55 | 14.65 | 0.75 | 1.57 | 24.89 | 100.49 | 3.7 |
| 86 | 3.7 | 19.69 | 14.73 | 0.75 | 1.55 | 24.99 | 98.99 | 4.6 |
| 86 | 4.2 | 19.82 | 14.79 | 0.75 | 1.54 | 25.08 | 97.50 | 5.7 |
| 86 | 4.4 | 19.87 | 14.81 | 0.75 | 1.54 | 25.11 | 96.99 | 6.2 |
| 86 | 4.6 | 19.89 | 14.80 | 0.74 | 1.53 | 25.12 | 96.52 | 6.7 |
| 86 | 5 | 19.97 | 14.85 | 0.74 | 1.53 | 25.17 | 95.70 | 7.8 |
| 95 | 2.7 | 18.16 | 14.13 | 0.78 | 1.68 | 23.89 | 111.83 | 2.6 |
| 95 | 3.3 | 18.41 | 14.22 | 0.77 | 1.66 | 24.06 | 108.90 | 3.6 |
| 95 | 3.7 | 18.54 | 14.30 | 0.77 | 1.64 | 24.14 | 107.45 | 4.5 |
| 95 | 4.2 | 18.64 | 14.30 | 0.77 | 1.63 | 24.20 | 106.01 | 5.6 |
| 95 | 4.4 | 18.34 | 14.15 | 0.77 | 1.67 | 24.03 | 105.48 | 6.1 |
| 95 | 4.6 | 18.73 | 14.34 | 0.77 | 1.62 | 24.27 | 105.09 | 6.6 |
| 95 | 5 | 18.80 | 14.37 | 0.76 | 1.62 | 24.32 | 104.31 | 7.6 |
| 105 | 2.7 | 16.86 | 13.59 | 0.81 | 1.77 | 22.91 | 120.97 | 2.5 |
| 105 | 3.3 | 17.09 | 13.70 | 0.80 | 1.75 | 23.07 | 118.19 | 3.5 |
| 105 | 3.7 | 17.16 | 13.69 | 0.80 | 1.74 | 23.11 | 116.79 | 4.3 |
| 105 | 4.2 | 17.32 | 13.80 | 0.80 | 1.73 | 23.23 | 115.46 | 5.4 |
| 105 | 4.4 | 17.35 | 13.81 | 0.80 | 1.73 | 23.25 | 115.00 | 5.9 |
| 105 | 4.6 | 17.39 | 13.82 | 0.79 | 1.73 | 23.28 | 114.58 | 6.4 |
| 105 | 5 | 17.47 | 13.87 | 0.79 | 1.72 | 23.34 | 113.84 | 7.4 |
| 115 | 2.7 | 15.52 | 13.07 | 0.84 | 1.86 | 21.87 | 130.06 | 2.4 |
| 115 | 3.3 | 15.69 | 13.13 | 0.84 | 1.84 | 21.97 | 127.41 | 3.5 |
| 115 | 3.7 | 15.84 | 13.22 | 0.83 | 1.83 | 22.10 | 126.15 | 4.2 |
| 115 | 4.2 | 15.94 | 13.26 | 0.83 | 1.83 | 22.18 | 124.87 | 5.3 |
| 115 | 4.4 | 15.94 | 13.22 | 0.83 | 1.82 | 22.16 | 124.41 | 5.7 |
| 115 | 4.6 | 15.99 | 13.27 | 0.83 | 1.82 | 22.19 | 124.02 | 6.2 |

**Table 23. GEH/GEV 018 Cooling Performance (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 115 | 5 | 16.03 | 13.27 | 0.83 | 1.81 | 22.22 | 123.31 | 7.2 |
| 120 | 2.7 | 14.83 | 12.79 | 0.86 | 1.90 | 21.31 | 134.57 | 2.4 |
| 120 | 3.3 | 15.05 | 12.88 | 0.86 | 1.88 | 21.47 | 132.05 | 3.4 |
| 120 | 3.7 | 15.11 | 12.89 | 0.85 | 1.87 | 21.51 | 130.77 | 4.2 |
| 120 | 4.2 | 15.23 | 12.96 | 0.85 | 1.87 | 21.61 | 129.55 | 5.2 |
| 120 | 4.4 | 15.25 | 12.94 | 0.85 | 1.86 | 21.61 | 129.12 | 5.7 |
| 120 | 4.6 | 15.28 | 12.98 | 0.85 | 1.86 | 21.63 | 128.74 | 6.1 |
| 120 | 5 | 15.33 | 12.99 | 0.85 | 1.86 | 21.67 | 128.05 | 7.1 |

Cooling performance data is tabulated at 80.6 F DB/66.2 F WB entering air at ARI/ISO 13256-1 rated CFM. For ARI/ISO 13256-1 certified ratings, see Table 10. See Performance correction tables to correct performance at conditions other than those tabulated. Data shown is for unit performance only. Interpolation is permissible. Extrapolation is not.
Rated GPM: 4.2 Maximum CFM 684; Rated CFM 570; Maximum CFM 456

**Table 24. GEH/GEV 018 Heating Performance**

| EWT | GPM | Htg. Cap. Mbtuh | Absorb Mbtuh | Power kW | LWT | Feet Head |
|---|---|---|---|---|---|---|
| 25 | 2.7 | 10.92 | 6.97 | 1.16 | 18.57 | 4.3 |
| 25 | 3.3 | 11.21 | 7.22 | 1.17 | 19.58 | 6.2 |
| 25 | 3.7 | 11.36 | 7.35 | 1.17 | 20.09 | 7.5 |
| 25 | 4.2 | 11.50 | 7.48 | 1.18 | 20.62 | 9.4 |
| 25 | 4.4 | 11.54 | 7.51 | 1.18 | 20.80 | 10.2 |
| 25 | 4.6 | 11.61 | 7.57 | 1.18 | 20.95 | 11.0 |
| 25 | 5.0 | 11.69 | 7.63 | 1.19 | 21.25 | 12.7 |
| 32 | 2.7 | 12.71 | 8.51 | 1.23 | 24.62 | 4.0 |
| 32 | 3.3 | 13.07 | 8.82 | 1.25 | 25.77 | 5.7 |
| 32 | 3.7 | 13.26 | 8.98 | 1.25 | 26.31 | 6.8 |
| 32 | 4.2 | 13.45 | 9.17 | 1.25 | 26.95 | 8.6 |
| 32 | 4.4 | 13.51 | 9.21 | 1.26 | 27.14 | 9.2 |
| 32 | 4.6 | 13.46 | 9.17 | 1.26 | 27.23 | 10.6 |
| 32 | 5.0 | 13.56 | 9.26 | 1.26 | 27.57 | 12.3 |
| 45 | 2.7 | 16.10 | 11.46 | 1.36 | 35.70 | 3.4 |
| 45 | 3.3 | 16.56 | 11.86 | 1.38 | 37.15 | 4.8 |
| 45 | 3.7 | 16.82 | 12.09 | 1.39 | 37.87 | 5.9 |
| 45 | 4.2 | 17.07 | 12.31 | 1.40 | 38.61 | 7.3 |
| 45 | 4.4 | 17.14 | 12.38 | 1.40 | 38.87 | 7.9 |
| 45 | 4.6 | 17.21 | 12.43 | 1.40 | 39.12 | 8.6 |
| 45 | 5.0 | 17.34 | 12.55 | 1.40 | 39.54 | 9.9 |
| 55 | 2.7 | 18.74 | 13.78 | 1.46 | 43.95 | 3.3 |
| 55 | 3.3 | 19.29 | 14.25 | 1.48 | 45.67 | 4.6 |
| 55 | 3.7 | 19.57 | 14.50 | 1.49 | 46.54 | 5.6 |
| 55 | 4.2 | 19.86 | 14.75 | 1.50 | 47.42 | 7.0 |
| 55 | 4.4 | 19.99 | 14.87 | 1.50 | 47.71 | 7.6 |
| 55 | 4.6 | 20.08 | 14.95 | 1.50 | 47.99 | 8.2 |
| 55 | 5.0 | 20.25 | 15.10 | 1.51 | 48.49 | 9.5 |
| 68 | 2.7 | 22.19 | 16.81 | 1.58 | 54.61 | 3.1 |
| 68 | 3.3 | 22.89 | 17.43 | 1.60 | 56.65 | 4.4 |
| 68 | 3.7 | 23.25 | 17.75 | 1.61 | 57.70 | 5.4 |
| 68 | 4.2 | 23.59 | 18.04 | 1.63 | 58.78 | 6.7 |
| 68 | 4.4 | 23.71 | 18.14 | 1.63 | 59.15 | 7.3 |
| 68 | 4.6 | 23.82 | 18.24 | 1.64 | 59.49 | 7.9 |
| 68 | 5.0 | 24.01 | 18.41 | 1.64 | 60.10 | 9.1 |
| 75 | 2.7 | 24.11 | 18.50 | 1.65 | 60.28 | 3.1 |
| 75 | 3.3 | 24.84 | 19.14 | 1.67 | 62.55 | 4.3 |
| 75 | 3.7 | 25.17 | 19.43 | 1.68 | 63.73 | 5.3 |
| 75 | 4.2 | 25.55 | 19.77 | 1.69 | 64.90 | 6.6 |
| 75 | 4.4 | 25.66 | 19.87 | 1.70 | 65.31 | 7.1 |
| 75 | 4.6 | 25.80 | 20.00 | 1.70 | 65.68 | 7.7 |

**Table 24. GEH/GEV 018 Heating Performance (continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| 75 | 5.0 | 25.99 | 20.16 | 1.71 | 66.35 | 8.9 |
| 86 | 2.7 | 27.02 | 21.08 | 1.74 | 69.24 | 2.9 |
| 86 | 3.3 | 27.80 | 21.77 | 1.77 | 71.84 | 4.2 |
| 86 | 3.7 | 28.22 | 22.14 | 1.78 | 73.16 | 5.1 |
| 86 | 4.2 | 28.59 | 22.48 | 1.79 | 74.52 | 6.3 |
| 86 | 4.4 | 28.73 | 22.60 | 1.80 | 74.98 | 6.9 |
| 86 | 4.6 | 28.77 | 22.65 | 1.80 | 75.44 | 7.4 |
| 86 | 5.0 | 28.83 | 22.71 | 1.80 | 76.26 | 8.6 |

Heating performance data is tabulated at 68 F DB entering air at ARI/ISO 13256-1 rated CFM. For ARI/ISO 13256-1 certified ratings, see Table 10. See Performance correction tables to correct performance at conditions other than those tabulated. Data shown is for unit performance only. Interpolation is permissible. Extrapolation is not.
Rated GPM: 4.2 Maximum CFM 684; Rated CFM 570; Minimum CFM 456

**Table 25. 018 Fan Correction Factors**

| Entering CFM | Cooling Capacity | Sensible Capacity | Cooling Input Watts | Heating Capacity | Heating Input Watts |
|---|---|---|---|---|---|
| 456 | 0.952 | 0.887 | 0.992 | 0.960 | 1.046 |
| 485 | 0.966 | 0.918 | 0.994 | 0.972 | 1.033 |
| 513 | 0.978 | 0.945 | 0.996 | 0.982 | 1.020 |
| 542 | 0.990 | 0.973 | 0.998 | 0.992 | 1.011 |
| 570 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 627 | 1.021 | 1.059 | 1.003 | 1.015 | 0.981 |
| 656 | 1.029 | 1.086 | 1.005 | 1.023 | 0.973 |
| 684 | 1.038 | 1.115 | 1.006 | 1.029 | 0.965 |

**Table 26. GEH/GEV 024 Cooling Performance**

| EWT | GPM | Total Mbtuh | Sen Mbtuh | SHR | Power kW | EER | Reject Mbtuh | LWT | Feet Head |
|---|---|---|---|---|---|---|---|---|---|
| 45 | 3.6 | 30.4 | 21.8 | 0.72 | 1.69 | 18.0 | 36.2 | 65.1 | 4.7 |
| 45 | 4.4 | 30.7 | 21.7 | 0.71 | 1.65 | 18.6 | 36.3 | 61.5 | 6.4 |
| 45 | 5.0 | 30.9 | 21.8 | 0.71 | 1.62 | 19.1 | 36.4 | 59.6 | 7.9 |
| 45 | 5.5 | 31.0 | 21.7 | 0.70 | 1.61 | 19.3 | 36.5 | 58.3 | 9.1 |
| 45 | 5.8 | 31.0 | 21.7 | 0.70 | 1.60 | 19.4 | 36.5 | 57.6 | 9.9 |
| 45 | 6.1 | 31.1 | 21.7 | 0.70 | 1.59 | 19.6 | 36.5 | 57.0 | 10.7 |
| 45 | 6.6 | 31.2 | 21.6 | 0.69 | 1.58 | 19.7 | 36.6 | 56.1 | 12.0 |
| 55 | 3.6 | 29.6 | 20.8 | 0.70 | 1.79 | 16.5 | 35.7 | 74.8 | 4.5 |
| 55 | 4.4 | 29.9 | 20.8 | 0.70 | 1.74 | 17.2 | 35.8 | 71.3 | 6.1 |
| 55 | 5.0 | 30.0 | 20.9 | 0.70 | 1.72 | 17.4 | 35.9 | 69.4 | 7.4 |
| 55 | 5.5 | 30.1 | 21.0 | 0.70 | 1.70 | 17.7 | 35.9 | 68.1 | 8.6 |
| 55 | 5.8 | 30.2 | 21.0 | 0.70 | 1.69 | 17.9 | 36.0 | 67.4 | 9.3 |
| 55 | 6.1 | 30.2 | 21.0 | 0.70 | 1.68 | 18.0 | 35.9 | 66.8 | 10.1 |
| 55 | 6.6 | 30.3 | 21.0 | 0.69 | 1.67 | 18.1 | 36.0 | 65.9 | 11.3 |
| 68 | 3.6 | 27.5 | 20.0 | 0.73 | 1.97 | 14.0 | 34.2 | 87.0 | 4.1 |
| 68 | 4.4 | 27.8 | 20.0 | 0.72 | 1.92 | 14.5 | 34.4 | 83.6 | 5.6 |
| 68 | 5.0 | 28.0 | 20.1 | 0.72 | 1.89 | 14.8 | 34.5 | 81.8 | 6.8 |
| 68 | 5.5 | 28.1 | 20.2 | 0.72 | 1.88 | 14.9 | 34.5 | 80.6 | 7.9 |
| 68 | 5.8 | 28.1 | 20.2 | 0.72 | 1.87 | 15.0 | 34.5 | 79.9 | 8.6 |
| 68 | 6.1 | 28.2 | 20.3 | 0.72 | 1.86 | 15.2 | 34.6 | 79.3 | 9.3 |
| 68 | 6.6 | 28.3 | 20.3 | 0.72 | 1.85 | 15.3 | 34.6 | 78.5 | 10.5 |
| 77 | 3.6 | 26.2 | 19.4 | 0.74 | 2.11 | 12.4 | 33.4 | 95.6 | 3.8 |
| 77 | 4.4 | 26.5 | 19.4 | 0.73 | 2.07 | 12.8 | 33.6 | 92.3 | 5.3 |
| 77 | 5.0 | 26.7 | 19.5 | 0.73 | 2.04 | 13.1 | 33.7 | 90.5 | 6.4 |
| 77 | 5.5 | 26.8 | 19.6 | 0.73 | 2.02 | 13.3 | 33.7 | 89.3 | 7.5 |
| 77 | 5.8 | 26.8 | 19.7 | 0.74 | 2.02 | 13.3 | 33.7 | 88.6 | 8.1 |
| 77 | 6.1 | 26.9 | 19.7 | 0.73 | 2.01 | 13.4 | 33.8 | 88.1 | 8.8 |
| 77 | 6.6 | 27.0 | 19.7 | 0.73 | 1.99 | 13.6 | 33.8 | 87.3 | 10.0 |
| 86 | 3.6 | 24.6 | 18.8 | 0.76 | 2.26 | 10.9 | 32.3 | 104.0 | 3.6 |
| 86 | 4.4 | 24.9 | 18.8 | 0.76 | 2.22 | 11.2 | 32.5 | 100.8 | 4.9 |
| 86 | 5.0 | 25.1 | 18.9 | 0.75 | 2.20 | 11.4 | 32.6 | 99.1 | 6.1 |
| 86 | 5.5 | 25.2 | 19.0 | 0.75 | 2.18 | 11.6 | 32.6 | 97.9 | 7.1 |
| 86 | 5.8 | 25.2 | 19.0 | 0.75 | 2.17 | 11.6 | 32.6 | 97.3 | 7.7 |
| 86 | 6.1 | 25.3 | 19.1 | 0.75 | 2.17 | 11.7 | 32.7 | 96.8 | 8.3 |
| 86 | 6.6 | 25.3 | 19.1 | 0.75 | 2.15 | 11.8 | 32.6 | 95.9 | 9.5 |
| 95 | 3.6 | 22.8 | 18.2 | 0.80 | 2.41 | 9.5 | 31.0 | 112.3 | 3.3 |
| 95 | 4.4 | 23.1 | 18.1 | 0.78 | 2.38 | 9.7 | 31.2 | 109.3 | 4.6 |
| 95 | 5.0 | 23.2 | 18.2 | 0.78 | 2.36 | 9.8 | 31.3 | 107.6 | 5.7 |
| 95 | 5.5 | 23.3 | 18.3 | 0.79 | 2.34 | 10.0 | 31.3 | 106.4 | 6.7 |
| 95 | 5.8 | 23.4 | 18.4 | 0.79 | 2.33 | 10.0 | 31.4 | 105.9 | 7.3 |
| 95 | 6.1 | 23.4 | 18.4 | 0.79 | 2.32 | 10.1 | 31.3 | 105.3 | 7.9 |
| 95 | 6.6 | 23.5 | 18.4 | 0.78 | 2.31 | 10.2 | 31.4 | 104.6 | 9.0 |
| 105 | 3.6 | 20.7 | 17.5 | 0.85 | 2.57 | 8.1 | 29.5 | 121.5 | 3.1 |
| 105 | 4.4 | 21.0 | 17.4 | 0.83 | 2.54 | 8.3 | 29.7 | 118.6 | 4.4 |
| 105 | 5.0 | 21.2 | 17.5 | 0.83 | 2.52 | 8.4 | 29.8 | 117.0 | 5.4 |
| 105 | 5.5 | 21.3 | 17.6 | 0.83 | 2.50 | 8.5 | 29.8 | 115.9 | 6.4 |
| 105 | 5.8 | 21.3 | 17.7 | 0.83 | 2.50 | 8.5 | 29.8 | 115.4 | 6.9 |
| 105 | 6.1 | 21.4 | 17.7 | 0.83 | 2.49 | 8.6 | 29.9 | 114.9 | 7.6 |
| 105 | 6.6 | 21.4 | 17.7 | 0.83 | 2.48 | 8.6 | 29.9 | 114.1 | 8.6 |
| 115 | 3.6 | 18.8 | 16.9 | 0.90 | 2.70 | 7.0 | 28.0 | 130.7 | 2.9 |
| 115 | 4.4 | 19.1 | 16.7 | 0.87 | 2.67 | 7.2 | 28.2 | 128.0 | 4.2 |
| 115 | 5.0 | 19.2 | 16.9 | 0.88 | 2.66 | 7.2 | 28.3 | 126.4 | 5.2 |
| 115 | 5.5 | 19.3 | 16.9 | 0.88 | 2.64 | 7.3 | 28.3 | 125.4 | 6.1 |
| 115 | 5.8 | 19.4 | 17.0 | 0.88 | 2.64 | 7.3 | 28.4 | 124.9 | 6.7 |

**Table 26. GEH/GEV 024 Cooling Performance (continued)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 115 | 6.1 | 19.4 | 17.0 | 0.88 | 2.63 | 7.4 | 28.4 | 124.4 | 7.3 |
| 115 | 6.6 | 19.5 | 17.1 | 0.88 | 2.62 | 7.4 | 28.4 | 123.7 | 8.3 |
| 120 | 3.6 | 17.9 | 16.5 | 0.92 | 2.74 | 6.5 | 27.3 | 135.3 | 2.9 |
| 120 | 4.4 | 18.2 | 16.4 | 0.90 | 2.73 | 6.7 | 27.5 | 132.7 | 4.1 |
| 120 | 5.0 | 18.4 | 16.5 | 0.90 | 2.71 | 6.8 | 27.7 | 131.2 | 5.1 |
| 120 | 5.5 | 18.5 | 16.6 | 0.90 | 2.70 | 6.9 | 27.7 | 130.2 | 6.0 |
| 120 | 5.8 | 18.5 | 16.7 | 0.90 | 2.70 | 6.9 | 27.7 | 129.7 | 6.6 |
| 120 | 6.1 | 18.6 | 16.7 | 0.90 | 2.69 | 6.9 | 27.8 | 129.2 | 7.2 |
| 120 | 6.6 | 18.6 | 16.7 | 0.90 | 2.68 | 6.9 | 27.8 | 128.5 | 8.2 |

Cooling performance data is tabulated at 80.6 F DB/66.2 F entering air at ARI/ISO 13256-1 rated CFM. For ARI/ISO 13256-1 certified ratings, see Table 10. See Performance correction tables to correct performance at conditions other than those tabulated. Data shown is for unit performance only. Interpolation is permissible. Extrapolation is not. Rated GPM: 5.5 Maximum CFM 608; Rated CFM 760; Maximum CFM 912

**Table 27. GEH/GEV 024 Heating Performance**

| EWT | GPM | Htg Cap Mbtuh | Absorb Mbtuh | Power kW | COP | LWT | Feet Head |
|---|---|---|---|---|---|---|---|
| 25 | 3.6 | 16.1 | 10.7 | 1.59 | 3.0 | 19.1 | 5.0 |
| 25 | 4.4 | 16.5 | 11.0 | 1.61 | 3.0 | 20.0 | 7.0 |
| 25 | 5.0 | 16.8 | 11.3 | 1.62 | 3.0 | 20.5 | 8.7 |
| 25 | 5.5 | 17.0 | 11.4 | 1.63 | 3.1 | 20.8 | 10.1 |
| 25 | 5.8 | 17.1 | 11.5 | 1.63 | 3.1 | 21.0 | 10.9 |
| 25 | 6.1 | 17.2 | 11.6 | 1.64 | 3.1 | 21.2 | 11.8 |
| 25 | 6.6 | 17.4 | 11.8 | 1.64 | 3.1 | 21.4 | 13.3 |
| 32 | 3.6 | 18.5 | 12.7 | 1.70 | 3.2 | 24.9 | 4.9 |
| 32 | 4.4 | 19.0 | 13.1 | 1.72 | 3.2 | 26.0 | 6.9 |
| 32 | 5.0 | 19.2 | 13.3 | 1.73 | 3.3 | 26.7 | 8.4 |
| 32 | 5.5 | 19.4 | 13.5 | 1.74 | 3.3 | 27.1 | 9.7 |
| 32 | 5.8 | 19.5 | 13.6 | 1.74 | 3.3 | 27.3 | 10.6 |
| 32 | 6.1 | 19.6 | 13.6 | 1.75 | 3.3 | 27.5 | 11.4 |
| 32 | 6.6 | 19.8 | 13.8 | 1.75 | 3.3 | 27.8 | 12.9 |
| 45 | 3.6 | 22.8 | 16.5 | 1.85 | 3.6 | 35.8 | 4.7 |
| 45 | 4.4 | 23.4 | 17.0 | 1.87 | 3.7 | 37.3 | 6.4 |
| 45 | 5.0 | 23.6 | 17.2 | 1.88 | 3.7 | 38.1 | 7.9 |
| 45 | 5.5 | 23.8 | 17.4 | 1.89 | 3.7 | 38.7 | 9.1 |
| 45 | 5.8 | 23.9 | 17.5 | 1.89 | 3.7 | 39.0 | 9.9 |
| 45 | 6.1 | 24.0 | 17.5 | 1.90 | 3.7 | 39.3 | 10.7 |
| 45 | 6.6 | 24.2 | 17.7 | 1.90 | 3.7 | 39.6 | 12.0 |
| 55 | 3.6 | 26.1 | 19.3 | 1.98 | 3.9 | 44.3 | 4.5 |
| 55 | 4.4 | 26.7 | 19.9 | 2.00 | 3.9 | 46.0 | 6.1 |
| 55 | 5.0 | 27.0 | 20.1 | 2.01 | 3.9 | 46.9 | 7.4 |
| 55 | 5.5 | 27.2 | 20.3 | 2.02 | 3.9 | 47.6 | 8.6 |
| 55 | 5.8 | 27.3 | 20.4 | 2.03 | 3.9 | 48.0 | 9.3 |
| 55 | 6.1 | 27.4 | 20.5 | 2.03 | 4.0 | 48.3 | 10.1 |
| 55 | 6.6 | 27.5 | 20.5 | 2.04 | 3.9 | 48.8 | 11.3 |
| 68 | 3.6 | 29.9 | 22.6 | 2.14 | 4.1 | 55.4 | 4.1 |
| 68 | 4.4 | 30.5 | 23.1 | 2.16 | 4.1 | 57.5 | 5.6 |
| 68 | 5.0 | 30.8 | 23.4 | 2.17 | 4.2 | 58.6 | 6.8 |
| 68 | 5.5 | 31.0 | 23.6 | 2.18 | 4.2 | 59.4 | 7.9 |
| 68 | 5.8 | 31.1 | 23.7 | 2.18 | 4.2 | 59.8 | 8.6 |
| 68 | 6.1 | 31.2 | 23.7 | 2.19 | 4.2 | 60.2 | 9.3 |
| 68 | 6.6 | 31.4 | 23.9 | 2.19 | 4.2 | 60.7 | 10.5 |
| 75 | 3.6 | 31.7 | 24.2 | 2.19 | 4.2 | 61.5 | 3.9 |
| 75 | 4.4 | 32.3 | 24.8 | 2.21 | 4.3 | 63.7 | 5.3 |
| 75 | 5.0 | 32.6 | 25.0 | 2.22 | 4.3 | 65.0 | 6.5 |
| 75 | 5.5 | 32.8 | 25.2 | 2.23 | 4.3 | 65.8 | 7.6 |
| 75 | 5.8 | 32.9 | 25.3 | 2.24 | 4.3 | 66.3 | 8.2 |
| 75 | 6.1 | 33.0 | 25.4 | 2.24 | 4.3 | 66.7 | 8.9 |

**Table 27. GEH/GEV 024 Heating Performance (continued)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 75 | 6.6 | 33.2 | 25.5 | 2.25 | 4.3 | 67.2 | 10.1 |
| 86 | 3.6 | 34.1 | 26.3 | 2.29 | 4.4 | 71.3 | 3.6 |
| 86 | 4.4 | 34.8 | 26.9 | 2.31 | 4.4 | 73.7 | 4.9 |
| 86 | 5.0 | 35.1 | 27.2 | 2.32 | 4.4 | 75.1 | 6.1 |
| 86 | 5.5 | 35.3 | 27.4 | 2.33 | 4.4 | 76.0 | 7.1 |
| 86 | 5.8 | 35.4 | 27.4 | 2.34 | 4.4 | 76.5 | 7.7 |
| 86 | 6.1 | 35.5 | 27.5 | 2.34 | 4.4 | 76.9 | 8.3 |
| 86 | 6.6 | 35.6 | 27.6 | 2.35 | 4.4 | 77.6 | 9.5 |

Heating performance data is tabulated at 68 F DBentering air at ARI/ISO 13256-1 rated CFM. For ARI/ISO 13256-1 certified ratings, see Table 10. See Performance correction tables to correct performance at conditions other than those tabulated. Data shown is for unit performance only. Interpolation is permissible. Extrapolation is not. Rated GPM: 5.5 Maximum CFM 608; Rated CFM 760; Maximum CFM 912

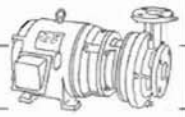
**Table 28. 024 Fan Correction Factors**

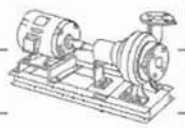
| Entering CFM | Cooling Capacity | Sensible Capacity | Cooling Input Watts | Heating Capacity | Heating Input Watts |
|---|---|---|---|---|---|
| 608 | 0.974 | 0.892 | 0.965 | 0.972 | 1.032 |
| 646 | 0.980 | 0.919 | 0.973 | 0.979 | 1.024 |
| 684 | 0.987 | 0.945 | 0.981 | 0.986 | 1.016 |
| 722 | 0.993 | 0.972 | 0.990 | 0.993 | 1.008 |
| 760 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 836 | 1.012 | 1.051 | 1.020 | 1.013 | 0.984 |
| 874 | 1.019 | 1.078 | 1.030 | 1.020 | 0.976 |
| 912 | 1.025 | 1.105 | 1.042 | 1.027 | 0.968 |

# Appendix M

## RS Means Mechanical Data

| | | CREW | OUTPUT | HOURS | UNIT | MAT. | LABOR | EQUIP. | TOTAL | INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1360 | 1/3 HP | Q-1 | 4 | 4 | Ea. | 1,475 | 154 | | 1,629 | 1,875 |
| 1400 | 1/2 HP | | 4 | 4 | | 1,500 | 154 | | 1,654 | 1,900 |
| 1440 | 3/4 HP | | 4 | 4 | | 1,650 | 154 | | 1,804 | 2,050 |
| 1480 | 1 HP | ▼ | 4 | 4 | ▼ | 2,650 | 154 | | 2,804 | 3,150 |
| 2000 | Cast iron, flange connection | | | | | | | | | |
| 2040 | 3/4" to 1-1/2" size, in line, 1/12 HP | Q-1 | 6 | 2.667 | Ea. | 239 | 102 | | 341 | 420 |
| 2060 | 1/8 HP | | 6 | 2.667 | | 400 | 102 | | 502 | 600 |
| 2080 | 1/3 HP | | 6 | 2.667 | | 445 | 102 | | 547 | 650 |
| 2140 | 2" size, 1/6 HP | | 5 | 3.200 | | 490 | 123 | | 613 | 725 |
| 2180 | 2-1/2" size, 1/4 HP | | 5 | 3.200 | | 625 | 123 | | 748 | 880 |
| 2220 | 3" size, 1/4 HP | | 4 | 4 | | 640 | 154 | | 794 | 940 |
| 2260 | 1/3 HP | | 4 | 4 | | 860 | 154 | | 1,014 | 1,175 |
| 2300 | 1/2 HP | | 4 | 4 | | 895 | 154 | | 1,049 | 1,225 |
| 2340 | 3/4 HP | | 4 | 4 | | 1,025 | 154 | | 1,179 | 1,375 |
| 2380 | 1 HP | ▼ | 4 | 4 | ▼ | 1,500 | 154 | | 1,654 | 1,900 |
| 2600 | For non-ferrous impeller, add | | | | | 3% | | | | |
| 3000 | High head, bronze impeller | | | | | | | | | |
| 3030 | 1-1/2" size 1/2 HP | Q-1 | 5 | 3.200 | Ea. | 740 | 123 | | 863 | 1,000 |
| 3040 | 1-1/2" size 3/4 HP | | 5 | 3.200 | | 790 | 123 | | 913 | 1,050 |
| 3050 | 2" size 1 HP | | 4 | 4 | | 950 | 154 | | 1,104 | 1,300 |
| 3090 | 2" size 1-1/2 HP | ▼ | 4 | 4 | ▼ | 1,100 | 154 | | 1,254 | 1,475 |
| 4000 | Close coupled, end suction, bronze impeller | | | | | | | | | |
| 4040 | 1-1/2" size, 1-1/2 HP, to 40 GPM | Q-1 | 3 | 5.333 | Ea. | 1,400 | 205 | | 1,605 | 1,850 |
| 4090 | 2" size, 2 HP, to 50 GPM | | 3 | 5.333 | | 1,650 | 205 | | 1,855 | 2,125 |
| 4100 | 2" size, 3 HP, to 90 GPM | | 2.30 | 6.957 | | 1,725 | 267 | | 1,992 | 2,300 |
| 4190 | 2-1/2" size, 3 HP, to 150 GPM | | 2 | 8 | | 1,850 | 305 | | 2,155 | 2,525 |
| 4300 | 3" size, 5 HP, to 225 GPM | | 1.80 | 8.889 | | 2,125 | 340 | | 2,465 | 2,850 |
| 4410 | 3" size, 10 HP, to 350 GPM | | 1.60 | 10 | | 2,850 | 385 | | 3,235 | 3,725 |
| 4420 | 4" size, 7-1/2 HP, to 350 GPM | ▼ | 1.60 | 10 | | 2,775 | 385 | | 3,160 | 3,650 |
| 4520 | 4" size, 10 HP, to 600 GPM | Q-2 | 1.70 | 14.118 | | 3,150 | 565 | | 3,715 | 4,350 |
| 4530 | 5" size, 15 HP, to 1000 GPM | | 1.70 | 14.118 | | 3,175 | 565 | | 3,740 | 4,375 |
| 4610 | 5" size, 20 HP, to 1350 GPM | | 1.50 | 16 | | 3,375 | 640 | | 4,015 | 4,700 |
| 4620 | 5" size, 25 HP, to 1550 GPM | ▼ | 1.50 | 16 | ▼ | 4,600 | 640 | | 5,240 | 6,050 |
| 5000 | Base mounted, bronze impeller, coupling guard | | | | | | | | | |
| 5040 | 1-1/2" size, 1-1/2 HP, to 40 GPM | Q-1 | 2.30 | 6.957 | Ea. | 2,650 | 267 | | 2,917 | 3,350 |
| 5090 | 2" size, 2 HP, to 50 GPM | | 2.30 | 6.957 | | 2,900 | 267 | | 3,167 | 3,625 |
| 5100 | 2" size, 3 HP, to 90 GPM | | 2 | 8 | | 2,925 | 305 | | 3,230 | 3,700 |
| 5190 | 2-1/2" size, 3 HP, to 150 GPM | | 1.80 | 8.889 | | 3,150 | 340 | | 3,490 | 4,000 |
| 5300 | 3" size, 5 HP, to 225 GPM | | 1.60 | 10 | | 2,825 | 385 | | 3,210 | 3,725 |
| 5410 | 4" size, 5 HP, to 350 GPM | | 1.50 | 10.667 | | 2,900 | 410 | | 3,310 | 3,825 |
| 5420 | 4" size, 7-1/2 HP, to 350 GPM | ▼ | 1.50 | 10.667 | | 3,025 | 410 | | 3,435 | 3,950 |
| 5520 | 5" size, 10 HP, to 600 GPM | Q-2 | 1.60 | 15 | | 3,650 | 600 | | 4,250 | 4,950 |
| 5530 | 5" size, 15 HP, to 1000 GPM | | 1.60 | 15 | | 3,800 | 600 | | 4,400 | 5,100 |
| 5610 | 6" size, 20 HP, to 1350 GPM | | 1.40 | 17.143 | | 4,925 | 685 | | 5,610 | 6,450 |
| 5620 | 6" size, 25 HP, to 1550 GPM | ▼ | 1.40 | 17.143 | ▼ | 5,050 | 685 | | 5,735 | 6,600 |
| 9000 | Minimum labor/equipment charge | Q-1 | 3.25 | 4.923 | Job | | 189 | | 189 | 294 |
| 0010 | **PUMPS, CONDENSATE RETURN SYSTEM** | | | | | | | | | |
| 0200 | Simplex, 3/4 H.P. mtr, float switch, controls, 10 Gal. C.I. rcvr, 6-15GPM | Q-1 | 1 | 16 | Ea. | 1,850 | 615 | | 2,465 | 2,975 |
| 1000 | Duplex, 2 pumps, 3/4 H.P. motors, float switch, | | | | | | | | | |
| 1060 | alternator asssembly, 15 Gal. C.I. receiver | Q-1 | .50 | 32 | Ea. | 5,050 | 1,225 | | 6,275 | 7,450 |
| 4400 | Refrigerant | | | | | | | | | |
| 4420 | Refrigerant, R-22, 50 lb. disposable cylinder | | | | Lb. | 2.54 | | | 2.54 | 2.79 |
| 4440 | Refrigerant, R-507, 25 lb. disposable cylinder | | | | " | 11.50 | | | 11.50 | 12.65 |
| 0010 | **STEAM CONDENSATE METER** | | | | | | | | | |
| 0100 | 500 lb. per hour | 1 Stpi | 14 | .571 | Ea. | 2,300 | 24.50 | | 2,324.50 | 2,575 |





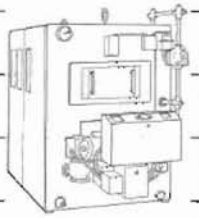
## 15107 | Metal Pipe & Fittings

| | | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 560 | 4496 | 6" x 6" x 4" | Q-1 | 5 | 3.200 | Ea. | 244 | 123 | | 367 | 460 |
| | 4500 | Tee/wye, long turn | | | | | | | | | |
| | 4520 | 1-1/2" | 1 Plum | 10 | .800 | Ea. | 28.50 | 34 | | 62.50 | 84 |
| | 4530 | 2" | Q-1 | 17 | .941 | | 35.50 | 36 | | 71.50 | 95 |
| | 4550 | 3" | | 11 | 1.455 | | 60.50 | 56 | | 116.50 | 154 |
| | 4570 | 4" | | 9 | 1.778 | | 85 | 68.50 | | 153.50 | 200 |
| | 4650 | Wye 45°, 1-1/2" | 1 Plum | 10 | .800 | | 21.50 | 34 | | 55.50 | 77 |
| | 4652 | 2" | Q-1 | 17 | .941 | | 31 | 36 | | 67 | 90 |
| | 4653 | 3" | | 11 | 1.455 | | 53.50 | 56 | | 109.50 | 146 |
| | 4654 | 4" | | 9 | 1.778 | | 78.50 | 68.50 | | 147 | 192 |
| | 4656 | 6" | | 5 | 3.200 | | 200 | 123 | | 323 | 410 |
| | 9000 | Minimum labor/equipment charge | 1 Plum | 4 | 2 | Job | | 85.50 | | 85.50 | 133 |
| 620 | 0010 | **PIPE, STEEL** R221113-50 | | | | | | | | | |
| | 0020 | All pipe sizes are to Spec. A-53 unless noted otherwise | | | | | | | | | |
| | 0030 | Schedule 10, see 15107-690-0500 | | | | | | | | | |
| | 0050 | Schedule 40, threaded, with couplings, and clevis type | | | | | | | | | |
| | 0060 | hangers sized for covering, 10' O.C. | | | | | | | | | |
| | 0540 | Black, 1/4" diameter | 1 Plum | 66 | .121 | L.F. | 2.04 | 5.20 | | 7.24 | 10.30 |
| | 0550 | 3/8" diameter | | 65 | .123 | | 2.03 | 5.25 | | 7.28 | 10.40 |
| | 0560 | 1/2" diameter | | 63 | .127 | | 2.05 | 5.40 | | 7.45 | 10.70 |
| | 0570 | 3/4" diameter | | 61 | .131 | | 2.40 | 5.60 | | 8 | 11.35 |
| | 0580 | 1" diameter | | 53 | .151 | | 3.47 | 6.45 | | 9.92 | 13.80 |
| | 0590 | 1-1/4" diameter | Q-1 | 89 | .180 | | 4.56 | 6.90 | | 11.46 | 15.75 |
| | 0600 | 1-1/2" diameter | | 80 | .200 | | 5.35 | 7.70 | | 13.05 | 17.85 |
| | 0610 | 2" diameter | | 64 | .250 | | 7.10 | 9.60 | | 16.70 | 23 |
| | 0620 | 2-1/2" diameter | | 50 | .320 | | 11 | 12.30 | | 23.30 | 31 |
| | 0630 | 3" diameter | | 43 | .372 | | 14.30 | 14.30 | | 28.60 | 37.50 |
| | 0640 | 3-1/2" diameter | | 40 | .400 | | 19.35 | 15.35 | | 34.70 | 45.50 |
| | 0650 | 4" diameter | | 36 | .444 | | 21 | 17.10 | | 38.10 | 49.50 |
| | 0660 | 5" diameter | | 26 | .615 | | 31.50 | 23.50 | | 55 | 71.50 |
| | 0670 | 6" diameter | Q-2 | 31 | .774 | | 46 | 31 | | 77 | 99 |
| | 0680 | 8" diameter | | 27 | .889 | | 71 | 35.50 | | 106.50 | 133 |
| | 0690 | 10" diameter | | 23 | 1.043 | | 99.50 | 41.50 | | 141 | 174 |
| | 0700 | 12" diameter | | 18 | 1.333 | | 110 | 53 | | 163 | 205 |
| | 0809 | A-106, gr. A/B, seamless w/cplgs. & hangers | | | | | | | | | |
| | 0811 | 1/4" diameter | 1 Plum | 66 | .121 | L.F. | 6.65 | 5.20 | | 11.85 | 15.40 |
| | 0812 | 3/8" diameter | | 65 | .123 | | 6.10 | 5.25 | | 11.35 | 14.90 |
| | 0813 | 1/2" diameter | | 63 | .127 | | 3.89 | 5.40 | | 9.29 | 12.75 |
| | 0814 | 3/4" diameter | | 61 | .131 | | 5.40 | 5.60 | | 11 | 14.60 |
| | 0815 | 1" diameter | | 53 | .151 | | 6.65 | 6.45 | | 13.10 | 17.30 |
| | 0816 | 1-1/4" diameter | Q-1 | 89 | .180 | | 8.40 | 6.90 | | 15.30 | 20 |
| | 0817 | 1-1/2" diameter | | 80 | .200 | | 10.20 | 7.70 | | 17.90 | 23 |
| | 0819 | A-53, 2" diameter | | 64 | .250 | | 11.50 | 9.60 | | 21.10 | 27.50 |
| | 0821 | 2-1/2" diameter | | 50 | .320 | | 14.25 | 12.30 | | 26.55 | 35 |
| | 0822 | 3" diameter | | 43 | .372 | | 18.55 | 14.30 | | 32.85 | 42.50 |
| | 0823 | 4" diameter | | 36 | .444 | | 28.50 | 17.10 | | 45.60 | 58 |
| | 1220 | To delete coupling & hanger, subtract | | | | | | | | | |
| | 1230 | 1/4" diam. to 3/4" diam. | | | | | 31% | 56% | | | |
| | 1240 | 1" diam. to 1-1/2" diam. | | | | | 23% | 51% | | | |
| | 1250 | 2" diam. to 4" diam. | | | | | 23% | 41% | | | |
| | 1260 | 5" diam. to 12" diam. | | | | | 21% | 45% | | | |
| | 1280 | All pipe sizes are to Spec. A-53 unless noted otherwise | | | | | | | | | |
| | 1281 | Schedule 40, threaded, with couplings and clevis type | | | | | | | | | |
| | 1282 | hangers sized for covering, 10' O. C. | | | | | | | | | |
| | 1290 | Galvanized, 1/4" diameter | 1 Plum | 66 | .121 | L.F. | 2.42 | 5.20 | | 7.62 | 10.70 |
| | 1300 | 3/8" diameter | | 65 | .123 | | 2.68 | 5.25 | | 7.93 | 11.10 |

## 15510 | Heating Boilers and Accessories

| | | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3040 | 122 MBH | R235000 -50 | Q-7 | 1.10 | 29.091 | Ea. | 1,850 | 1,200 | | 3,050 | 3,875 |
| 3060 | 163 MBH | | | 1 | 32 | | 2,225 | 1,325 | | 3,550 | 4,500 |
| 3080 | 203 MBH | | | 1 | 32 | | 2,475 | 1,325 | | 3,800 | 4,750 |
| 3100 | 240 MBH | | | .95 | 33.684 | | 2,600 | 1,375 | | 3,975 | 5,000 |
| 3120 | 280 MBH | | | .90 | 35.556 | | 2,650 | 1,450 | | 4,100 | 5,175 |
| 3140 | 320 MBH | | | .80 | 40 | | 3,050 | 1,650 | | 4,700 | 5,900 |
| 3160 | 360 MBH | | | .71 | 45.070 | | 3,475 | 1,850 | | 5,325 | 6,700 |
| 3180 | 400 MBH | | | .64 | 50 | | 3,700 | 2,050 | | 5,750 | 7,275 |
| 3200 | 440 MBH | | | .58 | 54.983 | | 3,975 | 2,250 | | 6,225 | 7,875 |
| 3220 | 544 MBH | | | .51 | 62.992 | | 6,825 | 2,575 | | 9,400 | 11,600 |
| 3240 | 765 MBH | | | .46 | 70.022 | | 8,275 | 2,875 | | 11,150 | 13,600 |
| 3260 | 1,088 MBH | | | .40 | 80 | | 10,300 | 3,275 | | 13,575 | 16,400 |
| 3280 | 1,275 MBH | | | .36 | 89.888 | | 11,800 | 3,700 | | 15,500 | 18,700 |
| 3300 | 1,530 MBH | | | .31 | 104 | | 12,400 | 4,300 | | 16,700 | 20,300 |
| 3320 | 2,000 MBH | | | .26 | 125 | | 13,400 | 5,125 | | 18,525 | 22,800 |
| 3340 | 2,312 MBH | | | .22 | 148 | | 15,500 | 6,075 | | 21,575 | 26,600 |
| 3360 | 2,856 MBH | | | .20 | 160 | | 18,300 | 6,575 | | 24,875 | 30,300 |
| 3380 | 3,264 MBH | | | .18 | 179 | | 19,400 | 7,375 | | 26,775 | 32,800 |
| 3400 | 3,808 MBH | | | .16 | 195 | | 21,400 | 8,000 | | 29,400 | 35,900 |
| 3420 | 4,488 MBH | | | .15 | 210 | | 23,800 | 8,650 | | 32,450 | 39,500 |
| 3440 | 4,720 MBH | | | .15 | 220 | | 54,000 | 9,050 | | 63,050 | 73,500 |
| 3460 | 5,520 MBH | | | .14 | 228 | | 61,000 | 9,375 | | 70,375 | 81,500 |
| 3480 | 6,100 MBH | | | .13 | 250 | | 61,500 | 10,300 | | 71,800 | 83,500 |
| 3500 | 6,390 MBH | | | .11 | 285 | | 63,000 | 11,700 | | 74,700 | 87,000 |
| 3520 | 6,680 MBH | | | .10 | 310 | | 66,500 | 12,700 | | 79,200 | 93,000 |
| 3540 | 6,970 MBH | | | .09 | 359 | | 69,000 | 14,800 | | 83,800 | 99,000 |
| 7000 | For tankless water heater, add | | | | | | 10% | | | | |
| 7050 | For additional zone valves up to 312 MBH add | | | | | | 124 | | | 124 | 136 |
| 7990 | Special feature gas fired boilers | | | | | | | | | | |
| 8000 | Pulse combustion, standard controls / trim | | | | | | | | | | |
| 8050 | 88,000 BTU | | Q-5 | 1.40 | 11.429 | Ea. | 4,000 | 445 | | 4,445 | 5,100 |
| 8080 | 134,000 BTU | | " | 1.20 | 13.333 | " | 4,775 | 515 | | 5,290 | 6,075 |
| 9900 | Minimum labor/equipment charge | | Q-6 | 1 | 24 | Job | | 965 | | 965 | 1,500 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **BOILERS, GAS/OIL** Combination with burners and controls | R235000 -50 | | | | | | | | | |
| 1000 | Cast iron with insulated jacket | | | | | | | | | | |
| 2000 | Steam, gross output, 720 MBH | | Q-7 | .43 | 74.074 | Ea. | 7,600 | 3,050 | | 10,650 | 13,100 |
| 2020 | 810 MBH | | | .38 | 83.990 | | 8,125 | 3,450 | | 11,575 | 14,300 |
| 2040 | 1,084 MBH | | | .34 | 93.023 | | 9,350 | 3,825 | | 13,175 | 16,200 |
| 2060 | 1,360 MBH | | | .33 | 98.160 | | 11,100 | 4,025 | | 15,125 | 18,500 |
| 2080 | 1,600 MBH | | | .30 | 107 | | 12,500 | 4,400 | | 16,900 | 20,500 |
| 2100 | 2,040 MBH | | | .25 | 130 | | 15,300 | 5,325 | | 20,625 | 25,200 |
| 2120 | 2,450 MBH | | | .21 | 156 | | 16,800 | 6,400 | | 23,200 | 28,500 |
| 2140 | 2,700 MBH | | | .19 | 165 | | 17,800 | 6,800 | | 24,600 | 30,100 |
| 2160 | 3,000 MBH | | | .18 | 175 | | 19,200 | 7,225 | | 26,425 | 32,300 |
| 2180 | 3,270 MBH | | | .17 | 183 | | 20,600 | 7,550 | | 28,150 | 34,400 |
| 2200 | 3,770 MBH | | | .17 | 191 | | 50,500 | 7,850 | | 58,350 | 67,500 |
| 2220 | 4,070 MBH | | | .16 | 200 | | 53,000 | 8,200 | | 61,200 | 71,500 |
| 2240 | 4,650 MBH | | | .15 | 210 | | 56,000 | 8,650 | | 64,650 | 75,000 |
| 2260 | 5,230 MBH | | | .14 | 223 | | 62,000 | 9,175 | | 71,175 | 82,500 |
| 2280 | 5,520 MBH | | | .14 | 235 | | 67,500 | 9,650 | | 77,150 | 89,000 |
| 2300 | 5,810 MBH | | | .13 | 248 | | 68,000 | 10,200 | | 78,200 | 91,000 |
| 2320 | 6,100 MBH | | | .12 | 260 | | 68,500 | 10,700 | | 79,200 | 92,000 |
| 2340 | 6,390 MBH | | | .11 | 296 | | 72,000 | 12,200 | | 84,200 | 98,500 |
| 2360 | 6,680 MBH | | | .10 | 320 | | 76,000 | 13,100 | | 89,100 | 104,000 |
| 2380 | 6,970 MBH | | | .09 | 372 | | 76,500 | 15,300 | | 91,800 | 107,500 |



## 15640 | Packaged Cooling Towers

| | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **COOLING TOWERS** Packaged units R262213-27 | | | | | | | | | |
| 0070 | Galvanized steel | | | | | | | | | |
| 0080 | Induced draft, crossflow | | | | | | | | | |
| 0100 | Vertical, belt drive, 61 tons | Q-6 | 90 | .267 | TonAC | 87 | 10.70 | | 97.70 | 112 |
| 0150 | 100 ton | | 100 | .240 | | 69 | 9.65 | | 78.65 | 91 |
| 0200 | 115 ton | | 109 | .220 | | 67 | 8.85 | | 75.85 | 88 |
| 0250 | 131 ton | | 120 | .200 | | 59.50 | 8.05 | | 67.55 | 78 |
| 0260 | 162 ton | ▼ | 132 | .182 | ▼ | 50 | 7.30 | | 57.30 | 66.50 |
| 1000 | For higher capacities, use multiples | | | | | | | | | |
| 1500 | Induced air, double flow | | | | | | | | | |
| 1900 | Vertical, gear drive, 167 ton | Q-6 | 126 | .190 | TonAC | 92.50 | 7.65 | | 100.15 | 114 |
| 2000 | 297 ton | | 129 | .186 | | 66 | 7.50 | | 73.50 | 84 |
| 2100 | 582 ton | | 132 | .182 | | 54.50 | 7.30 | | 61.80 | 71.50 |
| 2150 | 849 ton | | 142 | .169 | | 54 | 6.80 | | 60.80 | 70 |
| 2200 | 1016 ton | ▼ | 150 | .160 | ▼ | 51.50 | 6.45 | | 57.95 | 66.50 |
| 3000 | For higher capacities, use multiples | | | | | | | | | |
| 3500 | For pumps and piping, add | Q-6 | 38 | .632 | TonAC | 43.50 | 25.50 | | 69 | 87.50 |
| 4000 | For absorption systems, add | | | | " | 75% | 75% | | | |
| 5000 | Fiberglass | | | | | | | | | |
| 5010 | Draw thru | | | | | | | | | |
| 5100 | 60 ton | Q-6 | 1.50 | 16 | Ea. | 3,275 | 645 | | 3,920 | 4,600 |
| 5120 | 125 ton | | .99 | 24.242 | | 6,700 | 975 | | 7,675 | 8,900 |
| 5140 | 300 ton | | .43 | 55.814 | | 15,700 | 2,250 | | 17,950 | 20,800 |
| 5160 | 600 ton | | .22 | 109 | | 28,200 | 4,375 | | 32,575 | 37,800 |
| 5180 | 1000 ton | ▼ | .15 | 160 | ▼ | 48,400 | 6,425 | | 54,825 | 63,000 |
| 6000 | Stainless steel | | | | | | | | | |
| 6010 | Induced draft, crossflow, horizontal, belt drive | | | | | | | | | |
| 6100 | 57 ton | Q-6 | 1.50 | 16 | Ea. | 8,775 | 645 | | 9,420 | 10,700 |
| 6120 | 91 ton | | .99 | 24.242 | | 12,600 | 975 | | 13,575 | 15,400 |
| 6140 | 111 ton | | .43 | 55.814 | | 14,900 | 2,250 | | 17,150 | 19,900 |
| 6160 | 126 ton | ▼ | .22 | 109 | ▼ | 16,100 | 4,375 | | 20,475 | 24,500 |
| 6170 | Induced draft, crossflow, vertical, gear drive | | | | | | | | | |
| 6172 | 167 ton | Q-6 | .75 | 32 | Ea. | 25,900 | 1,275 | | 27,175 | 30,500 |
| 6174 | 297 ton | | .43 | 55.814 | | 33,300 | 2,250 | | 35,550 | 40,100 |
| 6176 | 582 ton | | .23 | 104 | | 52,500 | 4,200 | | 56,700 | 64,000 |
| 6178 | 849 ton | | .17 | 141 | | 84,000 | 5,675 | | 89,675 | 101,500 |
| 6180 | 1016 ton | | .15 | 160 | ▼ | 91,500 | 6,425 | | 97,925 | 111,000 |
| 9000 | Minimum labor/equipment charge | ▼ | 1 | 24 | Job | | 965 | | 965 | 1,500 |

## 15660 | Liquid Coolers/Evap Condensers

| | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **CONDENSERS** Ratings are for 30° F TD, R-22 R262213-27 | | | | | | | | | |
| 0080 | Air cooled, belt drive, propeller fan | | | | | | | | | |
| 0220 | 45 ton | Q-6 | .70 | 34.286 | Ea. | 10,200 | 1,375 | | 11,575 | 13,400 |
| 0240 | 50 ton | | .69 | 34.985 | | 10,500 | 1,400 | | 11,900 | 13,800 |
| 0260 | 54 ton | | .64 | 37.795 | | 10,900 | 1,525 | | 12,425 | 14,400 |
| 0280 | 59 ton | | .58 | 41.308 | | 11,700 | 1,650 | | 13,350 | 15,500 |
| 0300 | 65 ton | | .53 | 45.541 | | 12,200 | 1,825 | | 14,025 | 16,300 |
| 0320 | 73 ton | | .47 | 51.173 | | 13,800 | 2,050 | | 15,850 | 18,400 |
| 0340 | 81 ton | | .42 | 56.738 | | 15,700 | 2,275 | | 17,975 | 20,800 |
| 0360 | 86 ton | | .40 | 60.302 | | 16,400 | 2,425 | | 18,825 | 21,800 |
| 0380 | 88 ton | ▼ | .39 | 61.697 | | 17,500 | 2,475 | | 19,975 | 23,200 |
| 0400 | 101 ton | Q-7 | .45 | 70.640 | | 20,600 | 2,900 | | 23,500 | 27,200 |
| 0500 | 159 ton | | .31 | 102 | | 30,800 | 4,225 | | 35,025 | 40,400 |
| 0600 | 228 ton | | .22 | 148 | | 44,500 | 6,075 | | 50,575 | 58,500 |
| 0700 | 314 ton | | .16 | 203 | | 66,500 | 8,375 | | 74,875 | 86,500 |
| 0800 | 471 ton | ▼ | .11 | 283 | ▼ | 80,000 | 11,600 | | 91,600 | 106,000 |

| | 15730 \| Unitary Air Conditioning Equip | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0150 | 2 ton cooling | R262213 -27 | Q-5 | 1.40 | 11.429 | Ea. | 1,800 | 445 | | 2,245 | 2,675 | 900 |
| 1000 | Ceiling mount | | | | | | | | | | | |
| 1020 | 2 ton cooling | | Q-5 | 1.40 | 11.429 | Ea. | 1,225 | 445 | | 1,670 | 2,050 | |
| 1030 | 3 ton cooling | | " | 1.20 | 13.333 | " | 3,300 | 515 | | 3,815 | 4,425 | |
| 2000 | T-Bar mount | | | | | | | | | | | |
| 2010 | 2 ton cooling | | Q-5 | 1.40 | 11.429 | Ea. | 2,450 | 445 | | 2,895 | 3,400 | |
| 2020 | 3 ton cooling | | | 1.20 | 13.333 | | 2,950 | 515 | | 3,465 | 4,050 | |
| 2030 | 3-1/2 ton cooling | | | 1.10 | 14.545 | | 3,550 | 565 | | 4,115 | 4,775 | |
| 3000 | Multizone | | | | | | | | | | | |
| 3010 | Wall mount | | | | | | | | | | | |
| 3020 | 2 @ 3/4 ton cooling | | Q-5 | 1.80 | 8.889 | Ea. | 1,200 | 345 | | 1,545 | 1,850 | |
| 5000 | Cooling / Heating | | | | | | | | | | | |
| 5010 | Wall mount | | | | | | | | | | | |
| 5110 | 1 ton cooling | | Q-5 | 1.70 | 9.412 | Ea. | 890 | 365 | | 1,255 | 1,550 | |
| 5120 | 1-1/2 ton cooling | | " | 1.50 | 10.667 | " | 1,425 | 415 | | 1,840 | 2,225 | |
| 5300 | Ceiling mount | | | | | | | | | | | |
| 5310 | 3 ton cooling | | Q-5 | 1 | 16 | Ea. | 3,825 | 620 | | 4,445 | 5,175 | |
| 7000 | Accessories for all split ductless systems | | | | | | | | | | | |
| 7010 | Add for ambient frost control | | Q-5 | 8 | 2 | Ea. | 120 | 77.50 | | 197.50 | 253 | |
| 7020 | Add for tube / wiring kit | | | | | | | | | | | |
| 7030 | 15' kit | | Q-5 | 32 | .500 | Ea. | 31.50 | 19.40 | | 50.90 | 65 | |
| 7040 | 35' kit | | " | 24 | .667 | " | 102 | 26 | | 128 | 152 | |

| | 15740 \| Heat Pumps | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | AIR-SOURCE HEAT PUMPS (Not including interconnecting tubing) | | | | | | | | | | | 100 |
| 1000 | Air to air, split system, not including curbs, pads, or ductwork | | | | | | | | | | | |
| 1005 | 1.5 ton cooling, 7 MBH heat @ 0° F | R235000 -50 | Q-5 | 1.22 | 13.115 | Ea. | 1,575 | 510 | | 2,085 | 2,525 | |
| 1020 | 2 ton cooling, 8.5 MBH heat @ 0° F | | | 1.20 | 13.333 | | 1,625 | 515 | | 2,140 | 2,600 | |
| 1030 | 2.5 ton cooling, 10 MBH heat @ 0° F | R262213 -27 | | 1 | 16 | | 1,825 | 620 | | 2,445 | 2,975 | |
| 1040 | 3 ton cooling, 13 MBH heat @ 0° F | | | .80 | 20 | | 1,975 | 775 | | 2,750 | 3,375 | |
| 1050 | 3.5 ton cooling, 18 MBH heat @ 0° F | | | .75 | 21.333 | | 2,275 | 825 | | 3,100 | 3,775 | |
| 1054 | 4 ton cooling, 24 MBH heat @ 0° F | | | .60 | 26.667 | | 2,475 | 1,025 | | 3,500 | 4,325 | |
| 1060 | 5 ton cooling, 27 MBH heat @ 0° F | | | .50 | 32 | | 2,825 | 1,250 | | 4,075 | 5,050 | |
| 1080 | 7.5 ton cooling, 33 MBH heat @ 0° F | | | .30 | 53.333 | | 6,250 | 2,075 | | 8,325 | 10,100 | |
| 1100 | 10 ton cooling, 50 MBH heat @ 0° F | | Q-6 | .38 | 63.158 | | 8,375 | 2,550 | | 10,925 | 13,200 | |
| 1120 | 15 ton cooling, 64 MBH heat @ 0° F | | | .26 | 92.308 | | 11,900 | 3,700 | | 15,600 | 18,900 | |
| 1130 | 20 ton cooling, 85 MBH heat @ 0° F | | | .20 | 120 | | 15,600 | 4,825 | | 20,425 | 24,700 | |
| 1140 | 25 ton cooling, 119 MBH heat @ 0° F | | | .20 | 120 | | 18,800 | 4,825 | | 23,625 | 28,200 | |
| 1300 | Supplementary electric heat coil, included | | | | | | | | | | | |
| 1500 | Single package, not including curbs, pads, or plenums | | | | | | | | | | | |
| 1502 | 1/2 ton cooling, supplementary heat not incl. | | Q-5 | 8 | 2 | Ea. | 1,025 | 77.50 | | 1,102.50 | 1,250 | |
| 1504 | 3/4 ton cooling, supplementary heat not incl. | | | 6 | 2.667 | | 1,100 | 103 | | 1,203 | 1,350 | |
| 1506 | 1 ton cooling, supplementary heat not incl. | | | 4 | 4 | | 1,275 | 155 | | 1,430 | 1,650 | |
| 1510 | 1.5 ton cooling, 5 MBH heat @ 0° F | | | 1.55 | 10.323 | | 2,225 | 400 | | 2,625 | 3,075 | |
| 1520 | 2 ton cooling, 6.5 MBH heat @ 0° F | | | 1.50 | 10.667 | | 2,525 | 415 | | 2,940 | 3,425 | |
| 1540 | 2.5 ton cooling, 8 MBH heat @ 0° F | | | 1.40 | 11.429 | | 2,750 | 445 | | 3,195 | 3,725 | |
| 1560 | 3 ton cooling, 10 MBH heat @ 0° F | | | 1.20 | 13.333 | | 3,025 | 515 | | 3,540 | 4,125 | |
| 1570 | 3.5 ton cooling, 11 MBH heat @ 0° F | | | 1 | 16 | | 3,300 | 620 | | 3,920 | 4,600 | |
| 1580 | 4 ton cooling, 13 MBH heat @ 0° F | | | .96 | 16.667 | | 3,550 | 645 | | 4,195 | 4,900 | |
| 1620 | 5 ton cooling, 27 MBH heat @ 0° F | | | .65 | 24.615 | | 3,825 | 955 | | 4,780 | 5,675 | |
| 1640 | 7.5 ton cooling, 35 MBH heat @ 0° F | | | .40 | 40 | | 5,850 | 1,550 | | 7,400 | 8,825 | |
| 1648 | 10 ton cooling, 45 MBH heat @ 0° F | | Q-6 | .40 | 60 | | 7,725 | 2,400 | | 10,125 | 12,300 | |
| 1652 | 12 ton cooling, 50 MBH heat @ 0° F | | " | .36 | 66.667 | | 10,000 | 2,675 | | 12,675 | 15,200 | |
| 1696 | Supplementary electric heat coil incl., except as noted | | | | | | | | | | | |
| 2010 | WATER-SOURCE HEAT PUMPS (Not including interconnecting tubing) | | | | | | | | | | | 800 |
| 2020 | Water source to air, single package | | | | | | | | | | | |

## 15740 | Heat Pumps

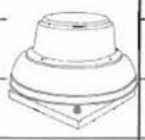
| | | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | 2100 | 1 ton cooling, 13 MBH heat @ 75° F | Q-5 | 2 | 8 | Ea. | 1,125 | 310 | | 1,435 | 1,725 |
| | 2120 | 1.5 ton cooling, 17 MBH heat @ 75° F | | 1.80 | 8.889 | | 1,250 | 345 | | 1,595 | 1,900 |
| | 2140 | 2 ton cooling, 19 MBH heat @ 75° F | | 1.70 | 9.412 | | 1,300 | 365 | | 1,665 | 2,000 |
| | 2160 | 2.5 ton cooling, 25 MBH heat @ 75° F | | 1.60 | 10 | | 1,375 | 390 | | 1,765 | 2,125 |
| | 2180 | 3 ton cooling, 27 MBH heat @ 75° F | | 1.40 | 11.429 | | 1,475 | 445 | | 1,920 | 2,325 |
| | 2190 | 3.5 ton cooling, 29 MBH heat @ 75° F | | 1.30 | 12.308 | | 1,525 | 475 | | 2,000 | 2,450 |
| | 2200 | 4 ton cooling, 31 MBH heat @ 75° F | | 1.20 | 13.333 | | 1,700 | 515 | | 2,215 | 2,675 |
| | 2220 | 5 ton cooling, 29 MBH heat @ 75° F | | .90 | 17.778 | | 2,000 | 690 | | 2,690 | 3,250 |
| | 2240 | 7.5 ton cooling, 35 MBH heat @ 75° F | | .60 | 26.667 | | 5,750 | 1,025 | | 6,775 | 7,925 |
| | 2250 | 8.5 ton cooling, 40 MBH heat @ 75° F | | .58 | 27.586 | | 6,200 | 1,075 | | 7,275 | 8,475 |
| | 2260 | 10 ton cooling, 50 MBH heat @ 75° F | | .53 | 30.189 | | 6,275 | 1,175 | | 7,450 | 8,725 |
| | 2280 | 15 ton cooling, 64 MBH heat @ 75° F | Q-6 | .47 | 51.064 | | 10,200 | 2,050 | | 12,250 | 14,500 |
| | 2300 | 20 ton cooling, 100 MBH heat @ 75° F | | .41 | 58.537 | | 11,200 | 2,350 | | 13,550 | 16,000 |
| | 2310 | 25 ton cooling, 100 MBH heat @ 75° F | | .32 | 75 | | 15,200 | 3,025 | | 18,225 | 21,400 |
| | 2320 | 30 ton cooling | | .24 | 102 | | 16,700 | 4,100 | | 20,800 | 24,800 |
| | 2340 | 40 ton cooling | | .21 | 117 | | 23,600 | 4,700 | | 28,300 | 33,200 |
| | 2360 | 50 ton cooling | | .15 | 160 | | 26,600 | 6,425 | | 33,025 | 39,300 |
| | 3960 | For supplementary heat coil, add | | | | | 10% | | | | |
| | 4000 | For increase in capacity thru use | | | | | | | | | |
| | 4020 | of solar collector, size boiler at 60% | | | | | | | | | |
| | 9000 | Minimum labor/equipment charge | Q-5 | 1.75 | 9.143 | Job | | 355 | | 355 | 550 |

## 15750 | Humidity Control Equipment

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 300 | 0010 | DEHUMIDIFIERS R236000 -30 | | | | | | | | | |
| | 6000 | Self contained with filters and standard controls | | | | | | | | | |
| | 6040 | 1.5 lb/hr, 50 cfm | 1 Plum | 8 | 1 | Ea. | 3,400 | 42.50 | | 3,442.50 | 3,825 |
| | 6060 | 3 lb/hr, 150 cfm | Q-1 | 12 | 1.333 | | 4,000 | 51 | | 4,051 | 4,475 |
| | 6065 | 6 lb/hr, 150 cfm | | 9 | 1.778 | | 7,200 | 68.50 | | 7,268.50 | 8,000 |
| | 6070 | 16 to 20 lb/hr, 600 cfm | | 5 | 3.200 | | 14,300 | 123 | | 14,423 | 15,900 |
| | 6080 | 30 to 40 lb/hr, 1125 cfm | | 4 | 4 | | 23,700 | 154 | | 23,854 | 26,200 |
| | 6090 | 60 to 75 lb/hr, 2250 cfm | | 3 | 5.333 | | 31,100 | 205 | | 31,305 | 34,500 |
| | 6100 | 120 to 155 lb/hr, 4500 cfm | | 2 | 8 | | 56,500 | 305 | | 56,805 | 63,000 |
| | 6110 | 240 to 310 lb/hr, 9000 cfm | | 1.50 | 10.667 | | 80,000 | 410 | | 80,410 | 88,500 |
| | 6120 | 400 to 515 lb/hr, 15,000 cfm | Q-2 | 1.60 | 15 | | 108,500 | 600 | | 109,100 | 120,500 |
| | 6130 | 530 to 690 lb/hr, 20,000 cfm | | 1.40 | 17.143 | | 117,500 | 685 | | 118,185 | 130,500 |
| | 6140 | 800 to 1030 lb/hr, 30,000 cfm | | 1.20 | 20 | | 134,000 | 795 | | 134,795 | 149,000 |
| | 6150 | 1060 to 1375 lb/hr, 40,000 cfm | | 1 | 24 | | 187,000 | 955 | | 187,955 | 207,500 |
| 500 | 0010 | HUMIDIFIERS | | | | | | | | | |
| | 0520 | Steam, room or duct, filter, regulators, auto. controls, 220 V | | | | | | | | | |
| | 0540 | 11 lb. per hour R236000 -30 | Q-5 | 6 | 2.667 | Ea. | 2,175 | 103 | | 2,278 | 2,550 |
| | 0560 | 22 lb. per hour | | 5 | 3.200 | | 2,400 | 124 | | 2,524 | 2,825 |
| | 0580 | 33 lb. per hour | | 4 | 4 | | 2,450 | 155 | | 2,605 | 2,925 |
| | 0600 | 50 lb. per hour | | 4 | 4 | | 3,025 | 155 | | 3,180 | 3,575 |
| | 0620 | 100 lb. per hour | | 3 | 5.333 | | 3,600 | 207 | | 3,807 | 4,300 |
| | 0640 | 150 lb. per hour | | 2.50 | 6.400 | | 4,775 | 248 | | 5,023 | 5,650 |
| | 0660 | 200 lb. per hour | | 2 | 8 | | 5,925 | 310 | | 6,235 | 6,975 |
| | 0700 | With blower | | | | | | | | | |
| | 0720 | 11 lb. per hour | Q-5 | 5.50 | 2.909 | Ea. | 3,025 | 113 | | 3,138 | 3,525 |
| | 0740 | 22 lb. per hour | | 4.75 | 3.368 | | 3,250 | 131 | | 3,381 | 3,775 |
| | 0760 | 33 lb. per hour | | 3.75 | 4.267 | | 3,325 | 165 | | 3,490 | 3,900 |
| | 0780 | 50 lb. per hour | | 3.50 | 4.571 | | 4,000 | 177 | | 4,177 | 4,675 |
| | 0800 | 100 lb. per hour | | 2.75 | 5.818 | | 4,500 | 225 | | 4,725 | 5,300 |
| | 0820 | 150 lb. per hour | | 2 | 8 | | 6,675 | 310 | | 6,985 | 7,825 |
| | 0840 | 200 lb. per hour | | 1.50 | 10.667 | | 7,825 | 415 | | 8,240 | 9,225 |
| | 5000 | Furnace type, wheel bypass | | | | | | | | | |

## 15830 | Fans

| | | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6620 | 54" x 54" | R233400 -10 | 1 Shee | 6 | 1.333 | Ea. | 208 | 56 | | 264 | 320 |
| 6630 | Timer, shut off, to 12 Hr. | | ↓ | 20 | .400 | ↓ | 33.50 | 16.85 | | 50.35 | 64 |
| 6650 | Residential, bath exhaust, grille, back draft damper | | | | | | | | | | |
| 6660 | 50 CFM | | Q-20 | 24 | .833 | Ea. | 30 | 32.50 | | 62.50 | 84 |
| 6670 | 110 CFM | | | 22 | .909 | | 50 | 35 | | 85 | 111 |
| 6680 | Light combination, squirrel cage, 100 watt, 70 CFM | | | 24 | .833 | | 63 | 32.50 | | 95.50 | 120 |
| 6700 | Light/heater combination, ceiling mounted | | | | | | | | | | |
| 6710 | 70 CFM, 1450 watt | | Q-20 | 24 | .833 | Ea. | 74.50 | 32.50 | | 107 | 133 |
| 6800 | Heater combination, recessed, 70 CFM | | | 24 | .833 | | 36 | 32.50 | | 68.50 | 90.50 |
| 6820 | With 2 infrared bulbs | | | 23 | .870 | | 53.50 | 33.50 | | 87 | 112 |
| 6900 | Kitchen exhaust, grille, complete, 160 CFM | | | 22 | .909 | | 63.50 | 35 | | 98.50 | 126 |
| 6910 | 180 CFM | | | 20 | 1 | | 54 | 38.50 | | 92.50 | 121 |
| 6920 | 270 CFM | | | 18 | 1.111 | | 97.50 | 43 | | 140.50 | 175 |
| 6930 | 350 CFM | | ↓ | 16 | 1.250 | ↓ | 74.50 | 48.50 | | 123 | 159 |
| 6940 | Residential roof jacks and wall caps | | | | | | | | | | |
| 6944 | Wall cap with back draft damper | | | | | | | | | | |
| 6946 | 3" & 4" dia. round duct | | 1 Shee | 11 | .727 | Ea. | 13.05 | 30.50 | | 43.55 | 63.50 |
| 6948 | 6" dia. round duct | | " | 11 | .727 | " | 31 | 30.50 | | 61.50 | 83 |
| 6958 | Roof jack with bird screen and back draft damper | | | | | | | | | | |
| 6960 | 3" & 4" dia. round duct | | 1 Shee | 11 | .727 | Ea. | 12.55 | 30.50 | | 43.05 | 63 |
| 6962 | 3-1/4" x 10" rectangular duct | | " | 10 | .800 | " | 22.50 | 33.50 | | 56 | 78.50 |
| 6980 | Transition | | | | | | | | | | |
| 6982 | 3-1/4" x 10" to 6" dia. round | | 1 Shee | 20 | .400 | Ea. | 13.85 | 16.85 | | 30.70 | 42.50 |
| 7000 | Roof exhauster, centrifugal, aluminum housing, 12" galvanized | | | | | | | | | | |
| 7020 | curb, bird screen, back draft damper, 1/4" S.P. | | | | | | | | | | |
| 7100 | Direct drive, 320 CFM, 11" sq. damper | | Q-20 | 7 | 2.857 | Ea. | 360 | 111 | | 471 | 570 |
| 7120 | 600 CFM, 11" sq. damper | | | 6 | 3.333 | | 365 | 129 | | 494 | 605 |
| 7140 | 815 CFM, 13" sq. damper | | | 5 | 4 | | 365 | 155 | | 520 | 645 |
| 7160 | 1450 CFM, 13" sq. damper | | | 4.20 | 4.762 | | 465 | 184 | | 649 | 800 |
| 7180 | 2050 CFM, 16" sq. damper | | | 4 | 5 | | 465 | 194 | | 659 | 815 |
| 7200 | V-belt drive, 1650 CFM, 12" sq. damper | | | 6 | 3.333 | | 790 | 129 | | 919 | 1,075 |
| 7220 | 2750 CFM, 21" sq. damper | | | 5 | 4 | | 890 | 155 | | 1,045 | 1,225 |
| 7230 | 3500 CFM, 21" sq. damper | | | 4.50 | 4.444 | | 985 | 172 | | 1,157 | 1,350 |
| 7240 | 4910 CFM, 23" sq. damper | | | 4 | 5 | | 1,225 | 194 | | 1,419 | 1,650 |
| 7260 | 8525 CFM, 28" sq. damper | | | 3 | 6.667 | | 1,525 | 258 | | 1,783 | 2,075 |
| 7280 | 13,760 CFM, 35" sq. damper | | | 2 | 10 | | 2,100 | 385 | | 2,485 | 2,925 |
| 7300 | 20,558 CFM, 43" sq. damper | | ↓ | 1 | 20 | | 4,475 | 775 | | 5,250 | 6,150 |
| 7320 | For 2 speed winding, add | | | | | | 15% | | | | |
| 7340 | For explosion-proof motor, add | | | | | | 330 | | | 330 | 360 |
| 7360 | For belt driven, top discharge, add | | | | | ↓ | 15% | | | | |
| 7500 | Utility set, steel construction, pedestal, 1/4" S.P. | | | | | | | | | | |
| 7520 | Direct drive, 150 CFM, 1/8 HP | | Q-20 | 6.40 | 3.125 | Ea. | 660 | 121 | | 781 | 915 |
| 7540 | 485 CFM, 1/6 HP | | | 5.80 | 3.448 | | 830 | 134 | | 964 | 1,125 |
| 7560 | 1950 CFM, 1/2 HP | | | 4.80 | 4.167 | | 970 | 161 | | 1,131 | 1,325 |
| 7580 | 2410 CFM, 3/4 HP | | | 4.40 | 4.545 | | 1,800 | 176 | | 1,976 | 2,250 |
| 7600 | 3328 CFM, 1-1/2 HP | | ↓ | 3 | 6.667 | ↓ | 2,000 | 258 | | 2,258 | 2,600 |
| 7680 | V-belt drive, drive cover, 3 phase | | | | | | | | | | |
| 7700 | 800 CFM, 1/4 HP | | Q-20 | 6 | 3.333 | Ea. | 520 | 129 | | 649 | 775 |
| 7720 | 1,300 CFM, 1/3 HP | | | 5 | 4 | | 545 | 155 | | 700 | 840 |
| 7740 | 2,000 CFM, 1 HP | | | 4.60 | 4.348 | | 640 | 168 | | 808 | 970 |
| 7760 | 2,900 CFM, 3/4 HP | | | 4.20 | 4.762 | | 865 | 184 | | 1,049 | 1,250 |
| 7780 | 3,600 CFM, 3/4 HP | | | 4 | 5 | | 1,075 | 194 | | 1,269 | 1,475 |
| 7800 | 4,800 CFM, 1 HP | | | 3.50 | 5.714 | | 1,250 | 221 | | 1,471 | 1,725 |
| 7820 | 6,700 CFM, 1-1/2 HP | | | 3 | 6.667 | | 1,550 | 258 | | 1,808 | 2,100 |
| 7830 | 7,500 CFM, 2 HP | | | 2.50 | 8 | | 2,100 | 310 | | 2,410 | 2,825 |
| 7840 | 11,000 CFM, 3 HP | | ↓ | 2 | 10 | ↓ | 2,825 | 385 | | 3,210 | 3,700 |

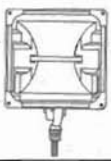


## 16510 | Interior Luminaires

| | | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | 2006 BARE COSTS MAT. | LABOR | EQUIP. | TOTAL | TOTAL INCL O&P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8270 | 24" diam. x 42" high, 6 light candle w/glass shade | R265113 -40 | 1 Elec | 6 | 1.333 | Ea. | 230 | 56 | | 286 | 340 |
| 8280 | 17" diam. x 12" high, 8 light w/glass panels | | | 8 | 1 | | 261 | 42 | | 303 | 350 |
| 8290 | 32" diam. x 48"H, 10 light bohemian lead crystal | R265723 -05 | | 4 | 2 | | 580 | 84 | | 664 | 770 |
| 8300 | 27" diam. x 29"H, 10 light bohemian lead crystal | | | 4 | 2 | | 540 | 84 | | 624 | 725 |
| 8310 | 21" diam. x 9" high 6 light sculptured ice crystal | R265723 -20 | | 8 | 1 | | 420 | 42 | | 462 | 525 |
| 8500 | Accent lights, on floor or edge, 0.5W low volt incand. | | | | | | | | | | |
| 8520 | incl. transformer & fastenings, based on 100' lengths | | | | | | | | | | |
| 8550 | Lights in clear tubing, 12" on center | | 1 Elec | 230 | .035 | L.F. | 7.70 | 1.46 | | 9.16 | 10.70 |
| 8560 | 6" on center | | | 160 | .050 | | 10 | 2.10 | | 12.10 | 14.25 |
| 8570 | 4" on center | | | 130 | .062 | | 15.30 | 2.58 | | 17.88 | 21 |
| 8580 | 3" on center | | | 125 | .064 | | 17 | 2.69 | | 19.69 | 23 |
| 8590 | 2" on center | | | 100 | .080 | | 24.50 | 3.36 | | 27.86 | 32 |
| 8600 | Carpet, lights both sides 6" OC, in alum. extrusion | | | 270 | .030 | | 23 | 1.24 | | 24.24 | 27.50 |
| 8610 | In bronze extrusion | | | 270 | .030 | | 26 | 1.24 | | 27.24 | 31 |
| 8620 | Carpet-bare floor, lights 18" OC, in alum. extrusion | | | 270 | .030 | | 18.50 | 1.24 | | 19.74 | 22.50 |
| 8630 | In bronze extrusion | | | 270 | .030 | | 21.50 | 1.24 | | 22.74 | 26 |
| 8640 | Carpet edge-wall, lights 6" OC in alum. extrusion | | | 270 | .030 | | 23 | 1.24 | | 24.24 | 27.50 |
| 8650 | In bronze extrusion | | | 270 | .030 | | 26 | 1.24 | | 27.24 | 31 |
| 8660 | Bare floor, lights 18" OC, in aluminum extrusion | | | 300 | .027 | | 18.50 | 1.12 | | 19.62 | 22 |
| 8670 | In bronze extrusion | | | 300 | .027 | | 21.50 | 1.12 | | 22.62 | 25.50 |
| 8680 | Bare floor conduit, aluminum extrusion | | | 300 | .027 | | 6.10 | 1.12 | | 7.22 | 8.50 |
| 8690 | In bronze extrusion | | | 300 | .027 | | 12.25 | 1.12 | | 13.37 | 15.20 |
| 8700 | Step edge to 36", lights 6" OC, in alum. extrusion | | | 100 | .080 | Ea. | 61.50 | 3.36 | | 64.86 | 73 |
| 8710 | In bronze extrusion | | | 100 | .080 | | 64 | 3.36 | | 67.36 | 75.50 |
| 8720 | Step edge to 54", lights 6" OC, in alum. extrusion | | | 100 | .080 | | 92.50 | 3.36 | | 95.86 | 107 |
| 8730 | In bronze extrusion | | | 100 | .080 | | 97.50 | 3.36 | | 100.86 | 112 |
| 8740 | Step edge to 72", lights 6" OC, in alum. extrusion | | | 100 | .080 | | 123 | 3.36 | | 126.36 | 141 |
| 8750 | In bronze extrusion | | | 100 | .080 | | 135 | 3.36 | | 138.36 | 153 |
| 8760 | Connector, male | | | 32 | .250 | | 2.28 | 10.50 | | 12.78 | 18.70 |
| 8770 | Female with pigtail | | | 32 | .250 | | 4.80 | 10.50 | | 15.30 | 21.50 |
| 8780 | Clamps | | | 400 | .020 | | .46 | .84 | | 1.30 | 1.80 |
| 8790 | Transformers, 50 watt | | | 8 | 1 | | 65 | 42 | | 107 | 136 |
| 8800 | 250 watt | | | 4 | 2 | | 222 | 84 | | 306 | 375 |
| 8810 | 1000 watt | | | 2.70 | 2.963 | | 410 | 124 | | 534 | 640 |
| 9000 | Minimum labor/equipment charge | | | 3 | 2.667 | Job | | 112 | | 112 | 173 |
| 0010 | **RESIDENTIAL FIXTURES** | | | | | | | | | | |
| 0400 | Fluorescent, interior, surface, circline, 32 watt & 40 watt | | 1 Elec | 20 | .400 | Ea. | 77.50 | 16.80 | | 94.30 | 112 |
| 0500 | 2' x 2', two U 40 watt | | | 8 | 1 | | 103 | 42 | | 145 | 179 |
| 0700 | Shallow under cabinet, two 20 watt | | | 16 | .500 | | 44 | 21 | | 65 | 81 |
| 0900 | Wall mounted, 4'L, one 40 watt, with baffle | | | 10 | .800 | | 119 | 33.50 | | 152.50 | 183 |
| 2000 | Incandescent, exterior lantern, wall mounted, 60 watt | | | 16 | .500 | | 31.50 | 21 | | 52.50 | 67.50 |
| 2100 | Post light, 150W, with 7' post | | | 4 | 2 | | 110 | 84 | | 194 | 250 |
| 2500 | Lamp holder, weatherproof with 150W PAR | | | 16 | .500 | | 19.50 | 21 | | 40.50 | 54 |
| 2550 | With reflector and guard | | | 12 | .667 | | 54.50 | 28 | | 82.50 | 103 |
| 2600 | Interior pendent, globe with shade, 150 watt | | | 20 | .400 | | 128 | 16.80 | | 144.80 | 167 |
| 9000 | Minimum labor/equipment charge | | | 4 | 2 | Job | | 84 | | 84 | 129 |

## 16520 | Exterior Luminaires

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | **EXTERIOR FIXTURES** With lamps | | | | | | | | | | |
| 0200 | Wall mounted, incandescent, 100 watt | | 1 Elec | 8 | 1 | Ea. | 28 | 42 | | 70 | 95.50 |
| 0400 | Quartz, 500 watt | | | 5.30 | 1.509 | | 54 | 63.50 | | 117.50 | 157 |
| 0420 | 1500 watt | | | 4.20 | 1.905 | | 102 | 80 | | 182 | 236 |
| 1100 | Wall pack, low pressure sodium, 35 watt | | | 4 | 2 | | 214 | 84 | | 298 | 365 |
| 1150 | 55 watt | | | 4 | 2 | | 255 | 84 | | 339 | 410 |



ELECTRICAL T6