# PUBLIC WORKS GARAGE

## STRATHROY, ONTARIO

### MEP DRAWING LIST


| | |
|---|---|
| E0.1 | SITE PLAN - ELECTRICAL |
| E1.1 | MAIN FLOOR PLAN - ELECTRICAL |
| E1.2 | SECOND FLOOR PLAN - ELECTRICAL |
| E1.3 | SCHEDULES & DETAILS - ELECTRICAL |
| E1.4 | SPECIFICATIONS - ELECTRICAL |
| E1.5 | SITE PHOTOS - ELECTRICAL |
| M1.1 | MAIN FLOOR PLAN - PLUMBING |
| M1.2 | SCHEDULES & DETAILS - PLUMBING |
| M2.1 | MAIN FLOOR PLAN - HVAC |
| M2.2 | SECOND FLOOR PLAN - HVAC |
| M2.3 | SCHEDULES & DETAILS - HVAC |
| M2.4 | SCHEDULES & DETAILS - HVAC |
| M2.5 | SPECIFICATIONS - MECHANICAL |


## PROPOSED GARAGE

**MIDDLESEX COUNTY**
**399 RIDOUT STREET NORTH**
**LONDON, ON N6A 2P1**

# ISSUED FOR TENDER

## SEPTEMBER 6, 2017


EMCAD

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GENERAL NOTES:

1. ALL PENETRATION THROUGH FIRE SEPARATIONS SHALL BE FIRE STOPPED IN ACCORDANCE WITH O.B.C. 3.1.8 & 3.1.9 AND ARCHITECTURAL PLANS AND SPECIFICATIONS.

2. CONTROLS FOR THE OPERATION OF BUILDING SERVICES OR SAFETY DEVICES INCLUDING SWITCHES, THERMOSTATS, INTERCOM SWITCHES, ALARMS AND KEYPADS, LOCATED WITHIN A BARRIER FREE PATH OF TRAVEL (AS OUTLINED IN O.B.C. 3.8.2.1.) SHALL BE MOUNTED AT 1200 MM ABOVE THE FINISHED FLOOR IN THE CASE OF A THERMOSTAT AND/OR A MANUAL PULL STATION AND NOT LESS THAN 900 MM AND NOT MORE THAN 1100 MM ABOVE THE FINISHED FLOOR IN THE CASE OF ALL OTHER CONTROLS, IN ACCORDANCE WITH O.B.C. 3.8.1.5. REFER TO ARCHITECTURAL DRAWINGS FOR AREAS DESIGNATED AS "BARRIER FREE PATH OF TRAVEL".

3. ALL MATERIALS AND SERVICES IN A CONCEALED SPACE USED AS A RETURN AIR PLENUM MUST COMPLY WITH O.B.C. 3.6.4.3 & 6.2.3.2, WHICH INCLUDES THAT THEY MUST HAVE A FLAME-SPREAD RATING OF NOT MORE THAN 25 AND A SMOKE DEVELOPED CLASSIFICATION NOT MORE THAN 50.

4. MECH. EQUIPMENT DIVISION OF RESPONSIBILITY:
UNLESS OTHERWISE NOTED ON THE DRAWINGS OR SPECIFICATIONS, MECHANICAL EQUIPMENT CONTROLS (THERMOSTATS, CONTROL PANELS, STARTERS, ETC.) AND LOW VOLTAGE WIRING AND CONDUIT ARE TO BE PROVIDED BY THE CONTRACTOR SUPPLYING THE EQUIPMENT BEING CONTROLLED. CONTROL WIRING IS TO BE 24 VOLT WHERE PRACTICAL UNLESS OTHERWISE NOTED ON THE DRAWINGS OR SPECIFICATIONS. ALL WIRING, CONDUITS AND DISCONNECTING MEANS 120 VOLT AND GREATER ARE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR. REVIEW REQUIREMENTS WITH LATEST SHOP DRAWINGS AND PERTINENT TRADES PRIOR TO ORDERING EQUIPMENT.

5. AS PER OBC SEC. 7.3.5.4 PROTECTION FROM FROST: WHERE PIPING MAY BE EXPOSED TO FREEZING CONDITIONS IT SHALL BE PROTECTED FROM THE EFFECTS OF FREEZING.

6. ALL PIPING IS TO BE INSTALLED WITH ADEQUATE CHANGE OF DIRECTION, EXPANSION JOINTS, GUIDES, AND ANCHORS, SO THAT THE PIPING AND EQUIPMENT WILL IN NO WAY BE STRAINED OR DISTORTED BY EXPANSION AND CONTRACTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT EXPANSION AND CONTRACTION IS ACCOUNTED FOR AND TO PROVIDE A LETTER TO EMCAD CONSULTING ENGINEERS (1995) INC. STATING THAT EXPANSION/CONTRACTION HAS BEEN ACCOUNTED FOR IN THE INSTALLATION PRIOR TO START-UP OF THE HEATING/COOLING SYSTEM AND DOMESTIC HOT WATER SYSTEM. REFER TO SPECIFICATION 230516 FOR MORE INFORMATION.

7. ALL EQUIPMENT, VALVES, BALANCING DAMPERS, FIRE DAMPERS, JUNCTION BOXES AND MAINTENANCE ITEMS LOCATED IN BULKHEADS, CEILINGS OR INACCESSIBLE SPACES SHALL BE PROVIDED WITH THE APPROPRIATELY RATED / INSULATED ACCESS PANELS. ACCESS PANELS TO BE PROVIDED BY CONTRACTOR INSTALLING THE COMPONENTS REQUIRING ACCESS.

8. IN ORDER TO MAINTAIN LONGEVITY OF COMBUSTIBLE CPVC PIPING SUCH AS BUT NOT LIMITED TO: BLAZEMASTER SPRINKLER PIPING, ALL CONTRACTORS ARE TO ENSURE NO PRODUCTS WITH RESIDUAL OILS SUCH AS BUT NOT LIMITED TO: ARMOURED CABLES, DUCTWORK, METAL STUDS, METAL CONDUIT & COMMUNICATION CABLES, ARE RUN IN CONTACT WITH COMBUSTIBLE CPVC PIPES.

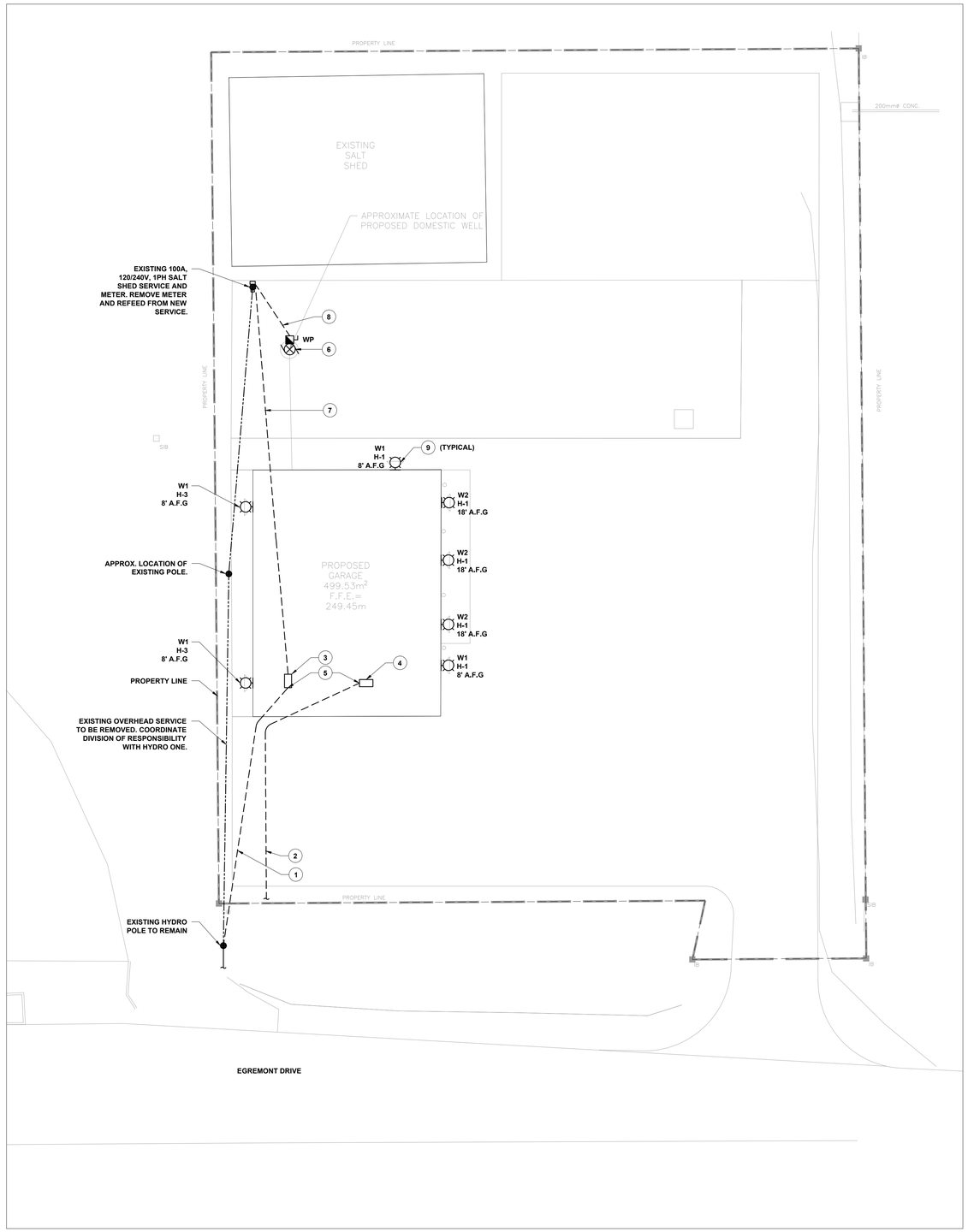
9. CONTRACTOR TO REVIEW ARCHITECTURAL REFLECTIVE CEILING PLANS FOR CEILING TYPES AND HEIGHTS ON ALL FLOOR PLANS.

10. MINIMUM HEIGHT FOR ALL PIPING, DUCTS, FIXTURES, CONDUITS, EQUIPMENT AND SIGNS IN THE PARKING AREA IS 6'-7" A.F.F. BARRIER-FREE PATH OF TRAVEL AND PARKING AREA MUST HAVE A MINIMUM HEIGHT OF 6'-11" A.F.F.

| IMAGE | SYMBOL | CATALOG NUMBER | DESCRIPTION |
|---|---|---|---|
| | W1 | WALL SCONCE<br>LITHONIA LIGHTING<br>CAT# WSR LED 1 10A700/40K SR3 MVOLT | 24W<br>LED<br>4000K |
| | W2 | WALL SCONCE<br>LITHONIA LIGHTING<br>CAT# WSR LED 2 10A700/40K SR3 MVOLT | 47W<br>LED<br>4000K |

# EXTERIOR LIGHT SCHEDULE

SCALE: N.T.S.




# SITE PLAN

SCALE: 1:250

**SERVICE UPGRADE SCOPE OF WORK:**

1. INTENT IS TO UPGRADE EXISTING 100A, 120/240V, SINGLE PHASE SERVICE FEEDING EXISTING SALT SHED WITH A NEW 200A, 120/208V, 3 PHASE SERVICE TO BE LOCATED IN PROPOSED GARAGE. EXISTING SALT SHED AND OTHER LOADS TO BE FED FROM NEW SERVICE.
2. COORDINATE SCOPE OF WORK AND DIVISION OF RESPONSIBILITY WITH KC LECRAW AT HYDRO ONE. (kc.lecraw@hydroone.com).
3. REMOVE DISUSED HYDRO POLES AS NECESSARY.
4. PROVIDE NEW U/G CONDUIT AND WIRING FROM RISER POLE TO LOCATION OF NEW SERVICE EQUIPMENT.
5. REFER TO DRAWINGS E1.3 AND E1.4 FOR SITE DISTRIBUTION DIAGRAM AND PHOTOS.

**DRAWING NOTES (DENOTED BY): #**

1. 4#250MCM AL. RWU90 IN 3"C INSTALLED PER OESC DIAGRAM D11 DETAIL 1. PROVIDE A SPARE 3"C FOR FUTURE EXPANSION. REFER TO DISTRIBUTION DIAGRAM FOR DETAILS.
2. 2-4" INCOMING CONDUITS C/W 1/2" NYLON PULL CORDS FOR COMMUNICATION SERVICES. CAP AND STAKE AT THE PROPERTY LINE. COORDINATE EXACT LOCATIONS WITH UTILITIES.
3. LOCATION OF SERVICE ENTRANCE EQUIPMENT WITHIN BUILDING. REFER TO DRAWING E1.1 FOR DETAILS.
4. LOCATION OF COMMUNICATION EQUIPMENT LOCATED IN UTILITY ROOM. REFER TO DRAWING E1.1 FOR DETAILS.
5. STUB UP CONDUIT AT SERVICE BOARD LOCATION. REFER TO DRAWING E1.1 FOR DETAILS.
6. $\frac{1}{2}$ HP, 208V, 1PH DOMESTIC WATER SUBMERSIBLE PUMP PROVIDED AND INSTALLED BY WELL CONTRACTOR. PROVIDE WIRING, CONNECTIONS AND DISCONNECTING MEANS PER OESC.
7. PROVIDE WIRING AND CONDUIT FOR EXISTING SERVICE AT SALT SHED. 3#1/0 AWG RW90 AL RW90 IN 2"C. REFER TO DISTRIBUTION DIAGRAM FOR DETAILS.
8. PROVIDE WIRING AND CONDUIT FOR DOMESTIC WELL PUMP. 2#10 AWG RW90 Cu. IN $\frac{3}{4}$"C.
9. REFER TO ARCHITECTURAL DRAWINGS FOR ELEVATIONS.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR TENDER | SEPT 6'17 |
| 0 | ISSUED FOR OWNER REVIEW | AUG 25'17 |

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LICENSED PROFESSIONAL ENGINEER
17089
Sept. 6'17
W.E. MOHAMED ALI
100106996
PROVINCE OF ONTARIO

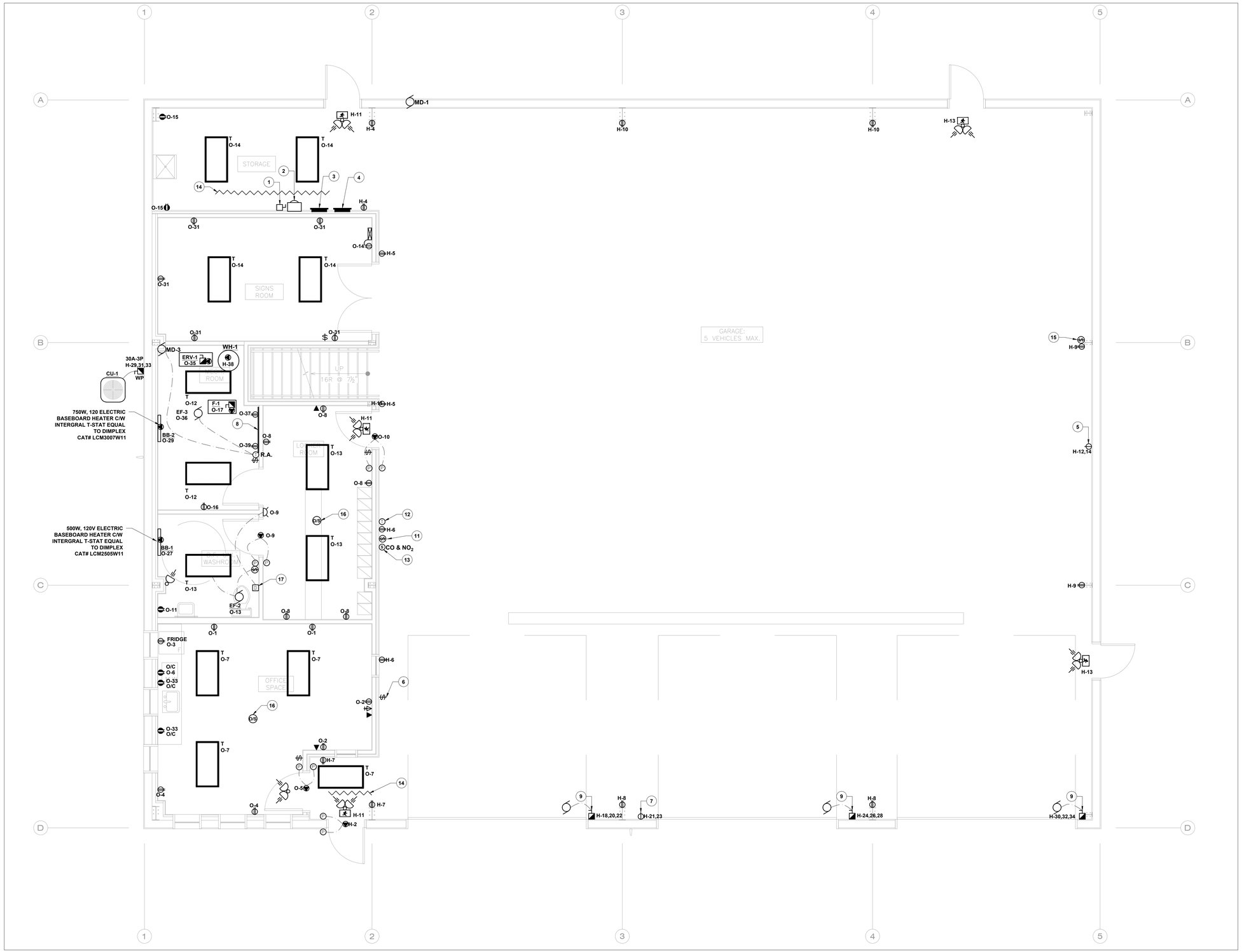
PROJECT # 17089

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**

STRATHROY ONTARIO

**SITE PLAN**
**-ELECTRICAL**

| | |
|---|---|
| DRAWN: TP | SCALE: 1:250 |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E0.1 | REVISION: R1 |




# MAIN FLOOR PLAN

SCALE: 1/4" = 1' - 0"

**DRAWING NOTES (DENOTED BY): (#)**

1. BUILDING MAIN DISCONNECT 200A, 120/208V. 3PH, 4W, FUSED AT 200A CLASS J.
2. 200A, 120/208V, 3PH, 4W METER SOCKET PER HYRDO ONE'S REQUIREMENTS.
3. 'PANEL-H' 200A, 120/208, 3PH, 4W, M.L.O., 42 CCT.
4. 'PANEL-O' 100A, 120/208V, 3PH, 4W, M.L.O., 42 CCT.
5. 30A, 240V WELDING RECEPTACLE. COORDINATE LOCATIONS ON SITE WITH G.C.
6. SWITCH TO CONTROL LIGHTS IN GARAGE.
7. 20A, 240V WASHER RECEPTACLE. OWNER TO CONFIRM LOCATION.
8. COMMUNICATION BACKBOARD 4' x 8' x $\frac{3}{4}$".
9. GARAGE DOOR OPENER LOCATION. COORDINATE REQUIREMENTS WITH OWNER.
10. RESERVED.
11. OCCUPANCY SENSOR SHALL BE EQUAL TO LEVITON MODEL # OSSMT-MDX-DUAL TECH WITH 30 MIN TIME DELAY. INTERLOCKED WITH MD-1 (LOW LEVEL) AND MD-1 & EF-1 (HIGH LEVEL). COORDINATE ON SITE WITH MECHANICAL CONTRACTOR.
12. T-STAT CONNECTED TO IR-1 AND IR-2 ON SECOND FLOOR. PROVIDED BY OTHERS.
13. $CO/NO_2$ MONITORING SYSTEM COMPLETE WITH OCCUPANCY SENSOR TO INTERLOCK WITH MD-2 AND EF-4 ON SECOND FLOOR. SENSORS ARE PROVIDED BY MECHANICAL AND WIRED BY ELECTRICAL. REFER TO DRAWING E1.3 FOR DETAILS. PROVIDE CONTACTORS AS NECESSARY. FED FROM CIRCUIT H-16. COORDINATE ON SITE WITH MECHANICAL CONTRACTOR.
14. PROVIDE WIRING AND CONNECTION FOR HEAT TRACE PROVIDED BY MECHANICAL CONTRACTOR. ENSURE GFCI PROTECTION. FED FROM H-19 & H-36. COORDINATE LOCATIONS ON-SITE WITH MECHANICAL CONTRACTOR.
15. OCCUPANCY SENSOR SHALL BE EQUAL TO LEVITON MODEL # OSSMT-MDX-DUAL TECH WITH 30 MIN TIME DELAY. INTERLOCKED WITH MD-1 (LOW LEVEL) AND MD-2 & EF-4 (HIGH LEVEL). COORDINATE ON SITE WITH MECHANICAL CONTRACTOR.
16. OCCUPANCY SENSOR SHALL BE EQUAL TO LEVITON MODEL # O2C10-MDW.
17. EMERGENCY DISTRESS BUTTON WITH HORN/STROBE LOCATED OUTSIDE B.F. WASHROOM. REFER TO DRAWING E1.3 FOR DETAILS.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

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PROVINCE OF ONTARIO

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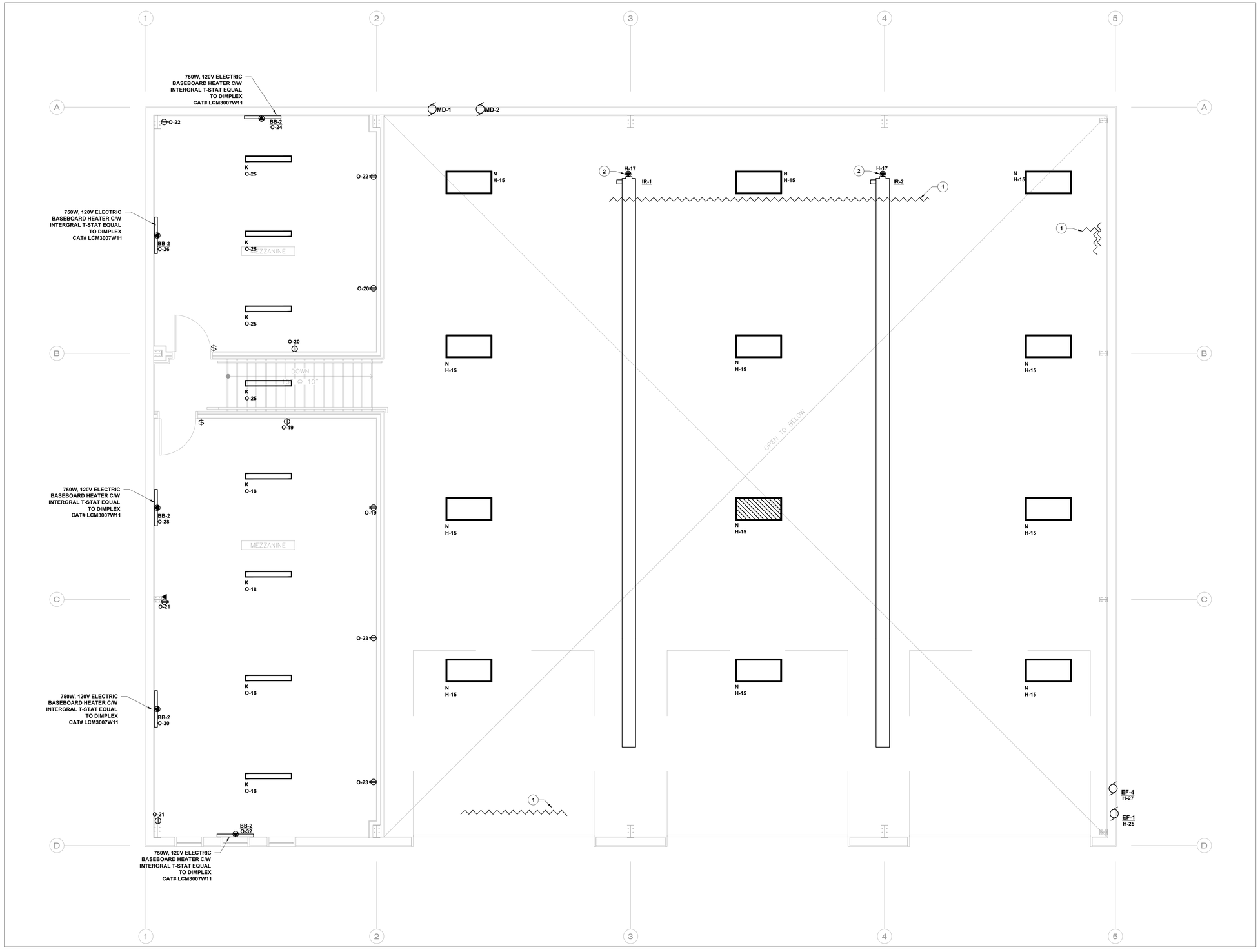
**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**MAIN FLOOR PLAN -ELECTRICAL**

| | |
|---|---|
| DRAWN: TP | SCALE: 1/4" = 1' - 0" |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E1.1 | REVISION: R2 |




# SECOND FLOOR PLAN

SCALE: 1/4" = 1' - 0"

**DRAWING NOTES (DENOTED BY): #**

1. PROVIDE WIRING AND CONNECTION FOR HEAT TRACE PROVIDED BY MECHANICAL CONTRACTOR. ENSURE GFCI PROTECTION. FED FROM H-19 & H-36. COORDINATE LOCATIONS ON-SITE WITH MECHANICAL CONTRACTOR.
2. INFRARED GAS FIRED HEATER. PROVIDE 120V DIRECT CONNECT. COORDINATE LOCATIONS ON SITE WITH MECHANICAL CONTRACTOR.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

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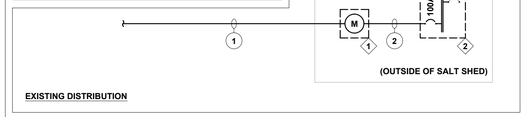
**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**SECOND FLOOR PLAN -ELECTRICAL**

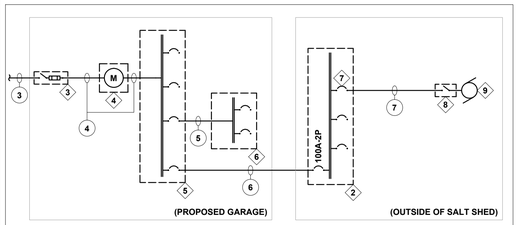
| | |
|---|---|
| DRAWN: TP | SCALE: 1/4" = 1' - 0" |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E1.2 | REVISION: R2 |

**NOTES:**

1. REFER TO PANEL SCHEDULES FOR BRANCH CIRCUIT BREAKER DETAILS.
2. ALL CONDUCTORS SHALL BE COPPER UNLESS OTHERWISE NOTED.
3. ALL GROUNDING PROCEDURES TO BE PERFORMED AS PER THE ONTARIO ELECTRICAL SAFETY CODE.
4. ENSURE TEMPERATURE RATING OF ELECTRICAL EQUIPMENT CORRESPONDS TO TEMPERATURE RATING OF ASSOCIATED CONDUCTORS OR ADJUST CONDUCTOR SIZING ACCORDINGLY.




EXISTING DISTRIBUTION




PROPOSED DISTRIBUTION

**FEEDER LEGEND (DENOTED BY): #**

1. EXISTING OVERHEAD TRIPLEX WIRE. INFORMATION UNAVAILABLE.
2. EXISTING WIRE AND CONDUIT. INFORMATION UNAVAILABLE.
3. PROVIDE 4#250MCM Al. RWU90 IN 3"C TO BE INSTALLED PER OESC DIAGRAM D11 DETAIL 1. PROVIDE A SPARE 3"C FOR FUTURE EXPANSION.
4. PROVIDE 4#250MCM Al. RW90 IN 3"C.
5. PROVIDE 4#1 AWG AL. RW90 IN 2"C.
6. PROVIDE 3#1/0 AWG RW90 AL RW90 IN 2"C .
7. PROVIDE 2#10 AWG RW90 CU. IN $\frac{3}{4}$"C.

**EQUIPMENT LEGEND (DENOTED BY): #**

1. EXISTING METER TO BE REMOVED.
2. EXISTING SALT SHED SERVICE TO REMAIN. 100A, 120/240V, 1PH.
3. PROVIDE BUILDING MAIN DISCONNECT 200A, 120/208V, 3PH, 4W, FUSED AT 200A CLASS J.
4. PROVIDE 200A, 120/208V, 3PH, 4W METER SOCKET TO HYDRO ONE'S REQUIREMENTS
5. PROVIDE 'PANEL-H', 200A, 120/208V, 3PH, 4W, M.L.O., 42 CCT.
6. PROVIDE 'PANEL-O', 100A, 120/208V, 3PH, 4W, M.L.O., 42 CCT.
7. PROVIDE A NEW 15A-2P BRANCH BREAKER FOR DOMESTIC WATER WELL.
8. PROVIDE 15A-2P WEATHER PROOF DISCONNECT PER OESC REQUIREMENTS.
9. $\frac{1}{2}$ HP, 208V, 1PH DOMESTIC WATER SUBMERSIBLE PUMP PROVIDED AND INSTALLED BY WELL CONTRACTOR.

## DISTRIBUTION SINGLE LINE DIAGRAM

N.T.S.

## FIXTURE SCHEDULE

| TYPE | DESCRIPTION | LAMPS |
|---|---|---|
| N | LED HIGH BAY<br>LITHONIA LIGHTING<br>CAT# IBL 15L ND LP840 | 125W<br>LED<br>4000K |
| K | 4' STRIP LIGHT (SUSPENDED)<br>LITHONIA LIGHTING<br>CAT# ZL2N L48 3000LM MDD MVOLT 40K 80CRI WH c/w HC36 | 42W<br>LED<br>4000K |
| T | 2' x 4' LED RECESSED TROFFER<br>LITHONIA LIGHTING<br>CAT# 2GTL 4 40L EZ1 LP840 | 38W<br>LED<br>4000K |

**NOTES:**

1. ALTERNATE FIXTURES MUST BE APPROVED BY THE OWNER.
2. REVIEW CEILING TYPES WITH THE LATEST ARCHITECTURAL DRAWINGS PRIOR TO ORDERING FIXTURES.

## LOAD CALCULATIONS

**NEW ELECTRICAL SERVICE CALCULATIONS:**

- BASIC LOADS:
  - MAIN FLOOR: = 14.34 kW
  - SECOND FLOOR: = 3.48 kW
- HVAC LOADS: = 5 kW
- SPECIAL LOADS: = 20 kW
- SERVICE: = 42.82 kW

@ 120V/208V = 119A

## LIGHTING CONTROLS

1. ALL EXTERIOR LIGHTS TO BE CONTROLLED BY WAY OF TIMER AND PHOTOCELL. PROVIDE COMPLETE WITH CONTACTOR, TIMECLOCK, SENSORS AND CONTROL WIRING.
2. INTERIOR LIGHTS TO BE CONTROLLED BY LOCAL SWITCHES AND OCCUPANY SENSORS AS INDICATED ON DRAWINGS.

## DIVISION OF RESPONSIBILITY

| ITEM | SUPPLIED BY | INSTALLED BY |
|---|---|---|
| 1. LIGHT FIXTURES | CONTRACTOR | CONTRACTOR |
| 2. COMMUNICATIONS RACEWAY (CONDUIT & BACKBOX) | CONTRACTOR | CONTRACTOR |
| 3. COMMUNICATIONS CABLING | OWNER | OWNER |
| 4. COMMUNICATIONS OUTLET AND COVER PLATES | CONTRACTOR | CONTRACTOR |

## LEGEND

| SYMBOL | DESCRIPTION |
|---|---|
| **EMERGENCY LIGHTING** | |
| | SINGLE FACE EXIT SIGN RUNNINGMAN- LED |
| | EXIT SIGN C/W DIRECTIONAL ARROWSRUNNINGMAN- LED |
| | SINGLE FACE EXIT SIGN WITH BATTERY BACK-UP RUNNING MAN-LED WITH BATT. BACKUP FOR 30MIN & 2-PAR16, 3W LED |
| | EMERGENCY BATTERY BACK-UP UNIT WITH 2-PAR18, 3W LED HEADS PROVIDING 36W OF POWER FOR 30MINS MINIMUM. |
| | EMERGENCY BATTERY BACK-UP UNIT WITHOUT HEADS. PROVIDING BACK-UP POWER FOR 30MINS MINIMUM. |
| | SINGLE HEAD REMOTE FIXTURE WITH 1-PAR18, 3W LED HEAD |
| | DOUBLE HEAD REMOTE FIXTURE WITH 2-PAR18, 3W LED HEADS |

THIS IS A STANDARD LEGEND ALL SYMBOLS MAY NOT NECESSARILY BE USED ON DRAWINGS

NOTES:
1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE PROPER BATTERIES ARE SELECTED TO ENSURE A MINIMUM OF 30 MINUTES OF BACK-UP POWER TO ALL REMOTE HEADS.
2. A MINIMUM OF 12V POWER IS REQUIRED IF REMOTE HEADS ARE USED.
3. THE MAXIMUM DISTANCE FOR ALLOWABLE VOLTAGE DROP ON A 12V SYSTEM USING #12 COPPER IS AS FOLLOWS:
   18W-110 FEET
   30W- 71 FEET
   50W- 42 FEET
4. ACCEPTABLE MANUFACTURERS ARE STANPRO, LUMACELL, EMERGI-LITE & BEGHELLI.

## LEGEND

| SYMBOL | DESCRIPTION |
|---|---|
| **LIGHTING** | |
| | 1X4 LIGHT FIXTURE |
| | 2X2 LIGHT FIXTURE |
| | 2X4 LIGHT FIXTURE |
| | 1X4 RECESSED LIGHT FIXTURE |
| | 2X2 RECESSED LIGHT FIXTURE |
| | 2X4 RECESSED LIGHT FIXTURE |
| | 1X4 EMERGENCY LIGHT FIXTURE |
| | 2X2 EMERGENCY LIGHT FIXTURE |
| | 2X4 EMERGENCY LIGHT FIXTURE |
| | 4' STRIP LIGHT FIXTURE |
| | TRACK LIGHTING |
| | POLE MOUNTED LIGHT FIXTURE |
| | CEILING MOUNTED LIGHT FIXTURE |
| | CEILING RECESSED LIGHT FIXTURE |
| | WALL SCONCE |
| | 2X2 NIGHT LIGHT FIXTURE |
| | 2X4 NIGHT LIGHT FIXTURE |
| **SWITCHES** | |
| | SINGLE SWITCH 347V 15A |
| | TWO GANG SWITCH |
| | THREE GANG SWITCH |
| | FOUR GANG SWITCH |
| | THREE-WAY SWITCH 120V 15A |
| | DIMMER SWITCH |
| | 10/20/30/60 MINUTE TIMER |
| | OCCUPANCY SENSOR |
| | OCCUPANCY SENSOR SWITCH |
| **RECEPTACLES** | |
| | SINGLE WALL RECEPTACLE |
| | DUPLEX RECEPTACLE 120V, 15A |
| | QUADPLEX RECEPTACLE 120V, 15A |
| | HALF SWITCH RECEPTACLE 120V, 15A |
| | G.F.C.I RECEPTACLE 120V, 15A |
| 50A | 50A RANGE RECEPTACLE |
| 30A | 30A DRYER RECEPTCLE |
| | DIRECT CONNECT |
| | SINGLE FLOOR RECEPTACLE |
| | DUPLEX FLOOR RECEPTACLE |
| | QUAD FLOOR RECEPTACLE |
| **EQUIPMENT** | |
| | POWER/LIGHTING PANEL |
| | SINGLE PHASE MOTOR |
| | THREE PHASE MOTOR |
| | FUSED DISCONNECT |
| | NON-FUSED DISCONNECT |
| | MAGNETIC STARTER |
| | MANUAL STARTER |
| | STARTER-COMB-FUSED |
| | START-COMB-NON-FUSED |
| | HEAT TRACE |

THIS IS A STANDARD LEGEND ALL SYMBOLS MAY NOT NECESSARILY BE USED ON DRAWINGS

## ABBREVIATIONS

| | |
|---|---|
| GFCI | GROUND FAULT PROTECTED CCT. |
| W.P | WEATHER PROOF |
| O/C | OVER COUNTER |
| MW | MOUNTED IN MILLWORK |
| EF | EXHAUST FAN |
| RE | DEVICE IN NEW RELOCATED POSITION |
| HL | MOUNTED AT A HIGH LEVEL |

THIS IS A STANDARD LEGEND ALL SYMBOLS MAY NOT NECESSARILY BE USED ON DRAWINGS

## MECHANICAL EQUIPMENT SCHEDULE

| ITEM | DESCRIPTION | LOAD (kW) | VOLTS (V) | RESPONSIBILITY | DISCONNECT | FEEDER |
|---|---|---|---|---|---|---|
| CU-1 | CONDENSING UNIT | 3.5 | 208 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 30A- 3P | 3#10 AWG RW90 CU. IN $\frac{3}{4}$" C |
| ERV-1 | VENTILATION FOR OFFICE | FHP | 115 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| IR-1 | GARAGE INFRARED HEATING | FHP | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | - | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| IR-2 | GARAGE INFRARED HEATING | FHP | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | - | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| F-1 | OFFICE FURNACE | 0.9 | 115 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| EF-1 | GARAGE EXHAUST FAN | 0.2 | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| EF-2 | WASHROOM EXHAUST FAN | FHP | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| EF-3 | MECHANICAL ROOM EXHAUST FAN | FHP | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| EF-3 | WORKSHOP EXHAUST FAN | 0.1 | 120 | PROVIDED & INSTALLED BY MECHANICAL, WIRED BY ELECTRICAL | 15A-1P | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| BB-1 | BASEBOARD HEATER | 0.5 | 120 | PROVIDED, INSTALLED & WIRED BY ELECTRICAL | - | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |
| BB-2 | BASEBOARD HEATER | 0.75 | 120 | PROVIDED, INSTALLED & WIRED BY ELECTRICAL | - | 2#12 AWG RW90 CU. IN $\frac{3}{4}$" C |

| DESCRIPTION | GFI | AFI | BREAKER | CONN. LOAD (W) | DIVER. FACTOR | DEMAND LOAD (W) | CCT | PHASE | CCT | DEMAND LOAD (W) | DIVER. FACTOR (%) | CONN. LOAD | BREAKER | AFI | GFI | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OFFICE SPACE RECEP # 1 | | | 15A-1P | 600 | 0.4 | 240 | 1 | A | 2 | 240 | 0.4 | 600 | 15A-1P | | | OFFICE SPACE RECEP #2 |
| FRIDGE | | | 20A-1P | 500 | 0.7 | 350 | 3 | B | 4 | 240 | 0.4 | 600 | 15A-1P | | | OFFICE SPACE RECEP #3 |
| OFFICE SPACE DOOR OPERATOR | | | 15A-1P | 50 | 0.4 | 20 | 5 | C | 6 | 480 | 0.4 | 1200 | 20A-1P | | | MICROWAVE |
| OFFICE SPACE LTG | | | 20A-1P | 152 | 0.7 | 106.4 | 7 | A | 8 | 600 | 0.4 | 1500 | 15A-1P | | | LOCKER RM RECEP |
| BATHROOM DOOR OPERATOR | | | 15A-1P | 50 | 0.4 | 20 | 9 | B | 10 | 20 | 0.4 | 50 | 15A-1P | | | LOCKER RM DOOR OPERATOR |
| BATHROOM RECEP | | | 15A-1P | 300 | 0.4 | 120 | 11 | C | 12 | 53.2 | 0.7 | 76 | 20A-1P | | | MECHANICAL RM LTG |
| BATHROOM & LOCKER RM LTG | | | 20A-1P | 152 | 0.7 | 106.4 | 13 | A | 14 | 131.6 | 0.7 | 188 | 20A-1P | | | STORAGE ROOM LTG |
| STORAGE RECEP | | | 15A-1P | 600 | 0.4 | 240 | 15 | B | 16 | 120 | 0.4 | 300 | 20A-1P | | | MECHANICAL RM RECEP |
| F-1 | | | 15A-1P | 900 | 0.7 | 630 | 17 | C | 18 | 114.8 | 0.7 | 164 | 20A-1P | | | SECOND FLR LTG #2 |
| SECOND FLR RECEP #1 | | | 15A-1P | 600 | 0.4 | 240 | 19 | A | 20 | 240 | 0.4 | 600 | 15A-1P | | | SECOND FLR RECEP #4 |
| SECOND FLR RECEP #2 | | | 15A-1P | 600 | 0.4 | 240 | 21 | B | 22 | 240 | 0.4 | 600 | 15A-1P | | | SECOND FLR RECEP #5 |
| SECOND FLR RECEP #3 | | | 15A-1P | 600 | 0.4 | 240 | 23 | C | 24 | 525 | 0.7 | 750 | 15A-1P | | | BB-2 #1 |
| SECOND FLR LTG #1 | | | 20A-1P | 164 | 0.7 | 114.8 | 25 | A | 26 | 525 | 0.7 | 750 | 15A-1P | | | BB-2 #2 |
| BB-1 #1 | | | 15A-1P | 500 | 0.7 | 350 | 27 | B | 28 | 525 | 0.7 | 750 | 15A-1P | | | BB-2 #3 |
| BB-2 #6 | | | 15A-1P | 750 | 0.7 | 525 | 29 | C | 30 | 525 | 0.7 | 750 | 15A-1P | | | BB-2 #4 |
| SIGN RM RECEP | | | 15A-1P | 1500 | 0.4 | 600 | 31 | A | 32 | 525 | 0.7 | 750 | 15A-1P | | | BB-2 #5 |
| OFFICE SPACE RECEP # 4 | | | 15A-1P | 600 | 0.4 | 240 | 33 | B | 34 | 25.2 | 0.7 | 36 | 15A-1P | | | EF-2 |
| ERV-1 | | | 15A-1P | 200 | 0.7 | 140 | 35 | C | 36 | 25.2 | 0.7 | 36 | 15A-1P | | | EF-3 |
| COMM RECEP | | | 15A-1P | | | 0 | 37 | A | 38 | 700 | 0.7 | 1000 | 15A-1P | | | WATER HEATER |
| COMM RECEP | | | 15A-1P | | | 0 | 39 | B | 40 | 0 | | | 15A-1P | | | SPARE |
| | | | | | | | 41 | C | 42 | | | | | | | SPARE |

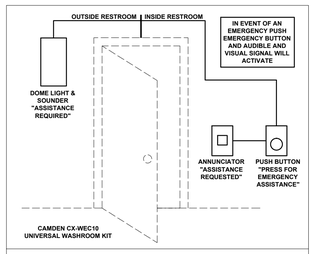
| | | | |
|---|---|---|---|
| PANEL ID: | PANEL O | DEMAND LOAD A (W) | 3810.8 |
| CURRENT RATING: | 100A | DEMAND LOAD B (W) | 2621.8 |
| VOLTAGE: | 120/208V | DEMAND LOAD C (W) | 2945.2 |
| PHASE: | 3PH | TOTAL DEMAND LOAD (W) | 9377.8 |
| WIRE: | 4W | | |
| LUGS: | M.L.O | DEMAND CURRENT A (A) | 10.58 |
| AIC RATING: | 14000 | DEMAND CURRENT B (A) | 7.28 |
| MOUNTING: | SURFACE | DEMAND CURRENT C (A) | 8.18 |
| | | TOTAL DEMAND CURRENT (A) | 26.03 |

NOTES:

| DESCRIPTION | GFI | AFI | BREAKER | CONN. LOAD (W) | DIVER. FACTOR | DEMAND LOAD (W) | CCT | PHASE | CCT | DEMAND LOAD (W) | DIVER. FACTOR (%) | CONN. LOAD | BREAKER | AFI | GFI | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXTERIOR LTG #1 | | | 20A-1P | 189 | 0.7 | 132.3 | 1 | A | 2 | 20 | 0.4 | 50 | 15A-1P | | | DOOR OPERATOR |
| EXTERIOR LTG #2 | | | 20A-1P | 48 | 0.7 | 33.6 | 3 | B | 4 | 240 | 0.4 | 600 | 15A-1P | | | GARAGE RECEP #1 |
| GARAGE RECEP #2 | | | 15A-1P | 600 | 0.75 | 450 | 5 | C | 6 | 240 | 0.4 | 600 | 15A-1P | | | GARAGE RECEP #3 |
| GARAGE RECEP #4 | | | 15A-1P | 600 | 0.4 | 240 | 7 | A | 8 | 240 | 0.4 | 600 | 15A-1P | | | GARAGE RECEP #5 |
| GARAGE RECEP #6 | | | 15A-1P | 600 | 0.4 | 240 | 9 | B | 10 | 240 | 0.4 | 600 | 15A-1P | | | GARAGE RECEP #7 |
| EXIT LTG | | | 15A-1P | 100 | 1 | 100 | 11 | C | 12 | 700 | 0.7 | 1000 | 30A-2P | | | WELDING RECEP |
| EXIT LTG | | | 15A-1P | 100 | 1 | 100 | 13 | A | 14 | 700 | 0.7 | 1000 | | | | |
| HIGH BAY LTG | | | 20A-1P | 1125 | 1 | 1125 | 15 | B | 16 | 100 | 1 | 100 | 15A-1P | | | N02/SO |
| IR-1, IR-2 | | | 15A-1P | 200 | 0.7 | 140 | 17 | C | 18 | 350 | 0.7 | 500 | 15A-3P | | | GARAGE DOOR OPENER 1 |
| HEAT TRACE | * | | 15A-1P | 300 | 0.7 | 210 | 19 | A | 20 | 350 | 0.7 | 500 | | | | |
| WASHER RECEP | | | 20A-2P | 750 | 0.7 | 525 | 21 | B | 22 | 350 | 0.7 | 500 | | | | |
| | | | | 750 | 0.7 | 525 | 23 | C | 24 | 350 | 0.7 | 500 | 15A-3P | | | GARAGE DOOR OPENER 2 |
| EF-1 | | | 15A-1P | 200 | 0.7 | 140 | 25 | A | 26 | 350 | 0.7 | 500 | | | | |
| EF-4 | | | 15A-1P | 100 | 0.7 | 70 | 27 | B | 28 | 350 | 0.7 | 500 | | | | |
| CU-1 | | | 30A-3P | 1200 | 0.7 | 840 | 29 | C | 30 | 350 | 0.7 | 500 | 15A-3P | | | GARAGE DOOR OPENER 3 |
| | | | | 1200 | 0.7 | 840 | 31 | A | 32 | 350 | 0.7 | 500 | | | | |
| | | | | 1200 | 0.7 | 840 | 33 | B | 34 | 350 | 0.7 | 500 | | | | |
| SPARE | | | 15A-1P | | | 0 | 35 | C | 36 | 210 | 0.7 | 300 | 15A-1P | | * | HEAT TRACE |
| PANEL O | | | 100A-3P | | | 3810.8 | 37 | A | 38 | 0 | | | 15A-1P | | | SPARE |
| | | | | | | 2621.8 | 39 | B | 40 | 0 | | | 15A-1P | | | SPARE |
| | | | | | | 2945.2 | 41 | C | 42 | 0 | | | 15A-1P | | | SPARE |

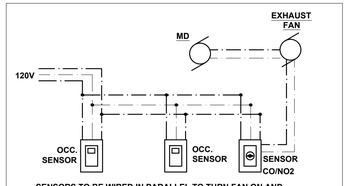
| | | | |
|---|---|---|---|
| PANEL ID: | PANEL H | DEMAND LOAD A (W) | 7198.1 |
| CURRENT RATING: | 200A | DEMAND LOAD B (W) | 5435.4 |
| VOLTAGE: | 120/208V | DEMAND LOAD C (W) | 7385.2 |
| PHASE: | 3PH | TOTAL DEMAND LOAD (W) | 20018.7 |
| WIRE: | 4W | | |
| LUGS: | M.L.O | DEMAND CURRENT A (A) | 19.98 |
| AIC RATING: | 14000 | DEMAND CURRENT B (A) | 15.09 |
| MOUNTING: | SURFACE | DEMAND CURRENT C (A) | 20.50 |
| | | TOTAL DEMAND CURRENT (A) | 55.57 |

NOTES:
1. CONFIRM GARAGE DOOR OPENER REQUIREMENTS WITH OWNER.




**B.F. WASHROOM DISTRESS BUTTON**

N.T.S.




SENSORS TO BE WIRED IN PARALLEL TO TURN FAN ON AND OPEN MOTORIZED DAMPER. FAN TO OPERATE UPON OCCUPANCY OR IF CO/NO2 SENSOR IS ACTIVATED.
ELECTRICAL TO PROVIDE AND INSTALL OCCUPANCY SENSORS & 120V WIRING & CONDUIT TO SENSORS AND FAN/DAMPER.

**FAN CONTROL SCHEMATIC**

N.T.S.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

**MIDDLESEX COUNTY**
**399 RIDOUT STREET NORTH**
**LONDON, ON N6A 2P1**


EMCAD Consulting Engineers
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T: 519.641.3040 F: 519.641.1634
E: general@emcad.ca
www.emcad.ca


LICENSED PROFESSIONAL ENGINEER 17089 Sept 6'17 W.E. MOHAMED ALI 100136996 PROVINCE OF ONTARIO

**PROJECT # 17089**

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
**STRATHROY ONTARIO**

**SCHEDULES & DETAILS -ELECTRICAL**

| | |
|---|---|
| DRAWN: TP | SCALE: N.T.S. |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E1.3 | REVISION: R2 |

ELECTRICAL SPECIFICATIONS

1. GENERAL ELECTRICAL

1.1. THE ELECTRICAL SPECIFICATION FORMS PART OF THE CONTRACT DOCUMENTS AND IS TO BE READ, INTERPRETED AND COORDINATED WITH ALL OTHER PARTS AND DIVISIONS. BID PRICING SHALL BE BASED ON UPON ALL SPECIFIED EQUIPMENT, DEVICES AND FIXTURES AS NOTED ON THE DRAWING AND IN THE ELECTRICAL SPECIFICATIONS. IDENTIFY ANY ALTERNATES INDIVIDUALLY ON THE FORM OF THE BID PRICING FOR REVIEW AND ACCEPTANCE.

1.2. THE WORD "PROVIDE" SHALL BE TAKEN TO MEAN SUPPLY, INSTALL, WIRE, TEST AND COMMISSION.

1.3. REGULATORY REQUIREMENTS:

1.3.1. COMPLY WITH ALL REQUIREMENTS OF THE CURRENT BUILDING CODE AND OF THE ONTARIO ELECTRICAL SAFETY CODE (CURRENT EDITION) INCLUDING ALL OTHER AMENDMENTS OR RULES REGULATING THE INSTALLATION OF ELECTRICAL EQUIPMENT. IN NO INSTANCES, HOWEVER, SHALL THE STANDARDS ESTABLISHED BY CONTRACT DOCUMENTS BE REDUCED BY ANY OF THESE CODES OR REGULATIONS.

1.3.2. WHERE REQUIRED BY REGULATIONS, BEFORE STARTING WORK SUBMIT THE APPROPRIATE QUANTITY OF PLANS AND SPECIFICATIONS TO THE ELECTRICAL SAFETY AUTHORITY AND OBTAIN ALL NECESSARY PERMITS. INCLUDE ALL COSTS OF PLAN APPROVALS AND PERMIT FEES IN THE TENDER.

1.3.3. ARRANGE FOR INSPECTION (AS WELL AS ATTENDANCE DURING VERIFICATION) OF THE WORK BY ALL APPLICABLE AUTHORITIES HAVING JURISDICTION. INCLUDE ALL INSPECTION COSTS IN THE TENDER PRICE.

1.3.4. UPON COMPLETION AND BEFORE FINAL PAYMENT WILL BE MADE, PRESENT TO THE CONSULTANT A CERTIFICATE OF UNCONDITIONAL APPROVAL FOR ALL ELECTRICAL WORK FROM THE ELECTRICAL SAFETY AUTHORITY AND OTHER AUTHORITIES HAVING JURISDICTION.

1.4. RESPONSIBILITY:

1.4.1. SUPPLY ALL LABOUR, MATERIALS, EQUIPMENT, TOOLS AND INCIDENTALS NECESSARY TO PROVIDE COMPLETE ELECTRICAL INSTALLATION AS INDICATED ON THE DRAWINGS AND AS SET OUT IN THESE SPECIFICATIONS AND ON THE ELECTRICAL DRAWINGS.

1.4.2. COORDINATE ALL ELECTRICAL WORK WITH THE WORK OF OTHER TRADES AND PROVIDE THE NECESSARY CONNECTIONS TO ENERGIZE ALL ITEMS OF EQUIPMENT PROVIDED BY OTHER TRADES.

1.5. INSURANCE:

1.5.1. MAINTAIN ALL NECESSARY INSURANCE TO PROTECT THE OWNER AND THE TRADES OF THIS DIVISION FROM ALL POSSIBLE CLAIMS.

1.6. GUARANTEE:

1.6.1. THE GUARANTEE PERIOD SHALL EXTEND ONE (1) YEAR FROM THE DATE OF ISSUE OF "SUBSTANTIAL COMPLETION" CERTIFICATE. ALL REPAIRS DURING THIS PERIOD ARE THE RESPONSIBILITY OF THIS DIVISION AT NO ADDITIONAL COST TO THE OWNER.

1.7. EXISTING CONDITIONS:

1.7.1. SUBMISSION OF A TENDER FOR THIS WORK SHALL BE TAKEN THAT THE CONTRACTOR HAS MADE A THOROUGH EXAMINATION OF THE SITE AND EXISTING CONDITIONS.

1.7.2. EXAMINE DRAWINGS OF ALL OTHER TRADES AND ALLOW FOR ALL WORK SUCH AS THE REMOVAL AND RE-INSTALLATION OF ELECTRICAL LUMINAIRES, EQUIPMENT, DEVICES, WIRING, RACEWAYS, ETC. WHERE SUCH WORK IS REQUIRED DUE TO ALTERATIONS IN OR ABOUT THE EXISTING BUILDING. REMOVE ALL SURPLUS CONDUITS, WIRING, LUMINAIRES AND DEVICES IN RENOVATED AREAS. BLANK OFF OR REMOVE ALL UNUSED OUTLET BOXES.

1.8. BASIC MATERIALS:

1.8.1. ALL MATERIALS SUPPLIED SHALL BE NEW, OF THE QUANTITIES INDICATED AND BE BEST COMMERCIAL QUALITY OBTAINABLE FOR THE PURPOSE.

1.9. APPROVALS:

1.9.1. APPROVAL OF EQUIPMENT AND ITS ALTERNATES WILL BE REVIEWED ONLY DURING THE PRICING PERIOD. ALL SUBMISSIONS SHALL INCLUDE THE FOLLOWING INFORMATION:

1.9.1.1. NAME AND IDENTIFICATION OF THE SPECIFIED ITEM

1.9.1.2. MANUFACTURER, BRAND NAME AND CATALOG NUMBER OF THE ALTERNATE ITEM PROPOSED.

1.9.1.3. DETAILED TECHNICAL INFORMATION AND CHARACTERISTICS OF ALTERNATE ITEM.

1.10. SHOP DRAWINGS:

1.10.1. SUBMIT SHOP DRAWINGS FOR ALL EQUIPMENT SPECIFIED ON THE DRAWINGS OR IN THE SPECIFICATIONS. ALL SHOP DRAWINGS SHALL CLEARLY INDICATE THE PROJECT NAME AND SHALL BEAR THE NAME OR IDENTIFICATION OF EACH PIECE OF EQUIPMENT. CONTRACTOR SHALL REVIEW THE SHOP DRAWINGS AND AFFIX REVIEW STAMP PRIOR TO SUBMISSION.

1.11. RECORD DRAWINGS:

1.11.1. MAINTAIN IN THE JOB SITE OFFICE, IN AN UP-TO-DATE CONDITION, ONE (1) COMPLETE SET OF THE ELECTRICAL CONTRACT DRAWINGS INCLUDING REVISION DRAWINGS, MARKED CLEARLY AND INDELIBLY IN RED, INDICATING "RECORD" CONDITIONS WHERE SUCH CONDITIONS ARE DEVIATIONS FROM THE ORIGINAL DIRECTIONS OF THE CONTRACT DOCUMENTS AND INDICATING FINAL INSTALLATION OF DEVICES AND BRANCH CIRCUITS.

1.11.2. SUCH MARKINGS SHALL INCLUDE BUT SHALL NOT BE LIMITED TO THE FOLLOWING:

1.11.2.1. ALL CHANGES IN CIRCUITING

1.11.2.2. ROUTING OF CONDUITS

1.11.2.3. NUMBER AND AWG OF CONDUCTORS (#10 AND LARGER) IN RACEWAYS AND CABLES

1.11.2.4. LOCATIONS OF ALL ACCESS PANELS

1.11.2.5. LOCATION OF JUNCTION AND PULL BOXES

1.11.2.6. LOCATION OF ALL CONDUIT, INSTALLED EQUIPMENT, DEVICES AND FIXTURES

1.11.2.7. ALL CHANGES TO ELECTRICAL INSTALLATION RESULTING FROM ADDENDUMS, CHARGE ORDERS, SITE INSTRUCTIONS AND CONTRACTOR CHANGES.

1.11.2.8. EXACT LOCATION OF ALL SERVICES LEFT FOR FUTURE WORK.

1.11.2.9. PROVIDE (1) COPY OF MARKED UP DRAWINGS AS OUTLINED IN 1.11.2 TO THE ELECTRICAL CONSULTANT PRIOR TO FINAL BUILDING OCCUPANCY.

1.12. MAINTENANCE MANUAL:

1.12.1. PROVIDE FOUR COPIES OF MAINTENANCE MANUALS USING RING BINDERS CONTAINING THE FOLLOWING INFORMATION:

1.12.1.1. COVER SHEET SHOWING NAMES OF OWNER, ARCHITECT, ELECTRICAL ENGINEER, GENERAL CONTRACTOR AND ELECTRICAL CONTRACTOR.

1.12.1.2. INDEX SHOWING EACH MAJORITY CATEGORY OF ELECTRICAL EQUIPMENT USED IN THIS PROJECT.

1.12.1.3. APPROVED SHOP DRAWINGS FOR ALL MAJOR EQUIPMENT.

1.12.1.4. LOCAL SOURCE OF SUPPLY OF MAJOR EQUIPMENT.

1.12.1.5. COPIES OF GUARANTEES, TESTS, AND CERTIFICATES.

1.12.1.6. COPY OF FINAL ACCEPTANCE FROM ELECTRICAL INSPECTOR.

1.12.1.7. SEISMIC ASSURANCE LETTER (IF REQUIRED)

1.13. WALL, CEILING AND FLOOR PENETRATIONS:

1.13.1. ANY AND ALL PENETRATIONS THROUGH WALLS, CEILINGS AND FLOORS (FIRE, SMOKE, SOUND AS WELL AS ALL OTHER PENETRATIONS) MUST BE SEALED AFTER THE INSTALLATIONS OF ALL WIRING AND RACEWAYS TO MAINTAIN THE INTEGRITY OF SEPARATIONS IN A MANNER APPROVED BY THE CONSULTANT AND THE AUTHORITIES HAVING JURISDICTION. USE SEALING MATERIAL AS MANUFACTURED BY FIRE STOP SYSTEMS, 3M FIRE BARRIER SYSTEM, OR APPROVED EQUAL.

1.13.2. PATCHING NEW STRUCTURES SHALL BE FINISHED TO MATCH THEIR ORIGINAL FINISH OR INTENDED FINISH. SEAL ALL SLOTS, CORE HOLES, ETC. NOT BEING USED.

1.13.3. ALL HOLES REQUIRED THROUGH STRUCTURAL STEEL (FABRICATION AND REINFORCING) SHALL BE CARRIED OUT BY AUTHORIZED PERSONNEL AS APPROVED BY THE CONSULTANT AND STRUCTURAL ENGINEER TO THEIR COMPLETE SATISFACTION AND SHALL BE PAID FOR BY THE ELECTRICAL CONTRACTOR.

1.13.4. CONTRACTOR SHALL BE RESPONSIBLE TO X-RAY ALL PENETRATIONS PRIOR TO CORING.

1.14. IDENTIFICATION:

1.14.1. IDENTIFY ALL PIECES OF ELECTRICAL EQUIPMENT (INCLUDING EACH AND EVERY RECEPTACLE) OTHER THAN CONDUITS AND CONDUCTORS ENGRAVED WITH LAMINATED PLASTIC NAMEPLATES OR BROTHER P-TOUCH LABELS HAVING 3MM MINIMUM HEIGHT. BLACK CHARACTERS ON WHITE BACKGROUND FOR NORMAL POWER. ATTACH ALL LAMACOID LABELS, UNLESS OTHERWISE DIRECTED WITH SILICONE CEMENT.

1.14.2. ALL JUNCTION AND PULLBOXES FOR CONDUITS, DUCTS AND OTHER RACEWAYS IN CONCEALED CEILING AND FLOOR SPACES SHALL BE PERMANENTLY MARKED USING A BLACK FELT PEN AS FOLLOWS: (WHERE CEILING SPACE IS PAINTED OUT, PUT MARKING ON INSIDE OF COVER PLATES).

1.14.2.1. FOR LIGHTING AND POWER SHOW THE COMPLETE CIRCUIT NUMBER OF ALL ENCLOSED CIRCUITS.

1.14.2.2. FOR COMMUNICATIONS AND FIRE ALARM SHOW THE USAGE (I.E. "FIRE ALARM"; "TELEPHONE").

1.15. MOUNTING HEIGHTS:

1.15.1. IN AREAS WHERE THERE IS NO CONFLICT WITH OTHER TRADES, MOUNTING HEIGHTS SPECIFIED HEREIN SHALL BE USED. MOUNTING HEIGHTS ARE FROM FINISHED FLOOR LEVEL TO CENTRE LINE OF DEVICE, UNLESS NOTED OTHERWISE:

1.15.1.1. WALL RECEPTACLES:

1.15.1.1.1. GENERALLY: 315MM (12")

1.15.1.1.2. FOR RANGES: 130MM (5") WITH U-GROUND SLOT ORIENTED TO THE SIDE

1.15.1.1.3. ABOVE TOP OF CONTINUOUS BASEBOARD HEATERS: 200MM (8")

1.15.1.1.4. ABOVE TOP OF COUNTER SPLASHBACKS: 150MM (6")

1.15.1.1.5. IN MECHANICAL ROOMS: 1400MM (4'-7")

1.15.1.2. TELEPHONE OUTLETS: GENERALLY 300MM (12")

1.15.1.3. THERMOSTATS: 1520MM (60")

1.15.1.4. FIRE ALARM BELLS:

1.15.1.5. FIRE ALARM PULL-STATIONS:

1.15.1.6. END OF LINE RESISTORS:

1.15.1.7. LOCAL BRANCH CIRCUIT LIGHTING SWITCHES:

1.15.1.8. MOTOR STARTERS AND DISCONNECT SWITCHES:

1.15.1.9. LIGHTING AND POWER PANELS:

1.15.1.10. EXIST SIGNS:

1.15.1.11. ALL SINGLE OUTLET MOUNTED OVER COUNTERS SHALL HAVE THEIR LONG AXIS OF THE OUTLET BOX MOUNTED HORIZONTALLY.

1.15.1.12. CONFIRM OUTLET MOUNTING HEIGHTS AND DIMENSIONS WITH GENERAL CONTRACTOR PRIOR TO ROUGH-IN.

2. BUILDING WIRE AND CABLE:

2.1. UNLESS OTHERWISE DIRECTED, BUILDING WIRE AND CABLE SHALL BE OF COPPER CONDUCTORS.

2.2. USE NO WIRE SMALLER THAN #12AWG, UNLESS OTHERWISE DIRECTED.

2.3. EXCEPT WHERE OTHERWISE DIRECTED OR REQUIRED BY CODE OR OTHER APPLICABLE REGULATIONS, BUILDING WIRE AND CABLE INSULATION SHALL BE TYPE RW90, CROSS-LINK, POLYETHYLENE INSULATED FOR 600V, AND RATED NOT LESS THAN 90 DEG. C.

2.4. ARMOURED CABLE MAY BE USED FOR THE FOLLOWING:

2.4.1. DROPS TO INDIVIDUAL LUMINAIRES AND SHALL HAVE A MAXIMUM LENGTH OF 1.5M (5').

2.4.2. FINAL CONNECTIONS TO MOTORS/ TRANSFORMERS OR VIBRATING EQUIPMENT. SUCH INSTALLATIONS MUST RUN PARALLEL TO OR AT RIGHT ANGLES TO BUILDING LINES AND MUST BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER.

2.4.3. DROPS FOR AND CONNECTIONS BETWEEN 15A, 120V SINGLE OR DUPLEX RECEPTACLES WITHIN A COMMON LENGTH OF STRAIGHT WALL STUD AND DRYWALL CONSTRUCTION. HORIZONTAL LENGTH SHALL NOT EXCEED 7.0M (23'). CEILING JUNCTION BOX TO BE LOCATED AS CLOSE AS POSSIBLE TO THE PARTITION WALL (NOT FURTHER AWAY THAN 915MM (36")).

2.5. ALL WIRING AND DEVICES SHALL BE RUN PARALLEL TO BUILDING LINES AND BE SOLIDLY SUPPORTED FROM BUILDING STRUCTURE (I.E. SUPPORT FROM DUCTWORK, CEILING SYSTEM, ETC. IS NOT PERMITTED).

2.6. CONDUCTORS FOR LIGHTING AND OTHER BRANCH CIRCUITS SHALL HAVE AN AMPACITY NOT LESS THAN THE RATING OF THE OVER-CURRENT DEVICE PROTECTING THE BRANCH CIRCUIT AND SHALL BE SIZED FOR A MAXIMUM VOLTAGE DROP OF 3% FROM PANELBOARD TO THE LAST OUTLET OF A CIRCUIT. THE LENGTH OF THE BRANCH CIRCUIT TO BE USED IN THE DETERMINATION OF THE REQUIRED SIZE SHALL BE THE TOTAL DISTANCE FROM THE ASSOCIATED PANELBOARD TO THE LAST DEVICE IN THE CIRCUIT. IN NO CASE SHALL THE WIRE SIZES BE LESS THAN THAT INDICATED BELOW:

2.6.1. 120V, 1-PHASE, 15A CIRCUITS:

2.6.1.1. 0 - 25M (82'): MINIMUM #12AWG

2.6.1.2. 25 - 40M (130'): MINIMUM #10AWG

2.6.1.3. OVER 40M: MINIMUM #8AWG

2.6.2. 120V, 1-PHASE, 20A CIRCUITS:

2.6.2.1. 0 - 20M (66'): MINIMUM #12AWG

2.6.2.2. 20 - 30M (100'): MINIMUM #10AWG

2.6.2.3. OVER 30M: MINIMUM #8AWG

3. CONDUITS:

3.1. ALL INTERIOR BRANCH CIRCUIT WIRING SHALL BE IN ELECTRICAL METALLIC TUBING (EMT). ALL FEEDER SHALL BE GALVANISED RIGID STEEL.

3.2. ALL FIRE ALARM CABLING SHALL BE RUN IN EMT CONDUIT.

3.3. CUT CONDUITS SQUARE USING A SAW OR PIPE CUTTER, DEBURR CUT ENDS.

3.4. BRING CONDUITS TO THE SHOULDER OF THE FITTING AND COUPLINGS AND FASTEN SECURELY.

3.5. USE CONDUIT HUBS OR SEALING LOCKNUTS FOR FASTENING CONDUITS TO CAST BOXES, AND FOR FASTENING CONDUITS TO SHEET METAL BOXES IN DAMP OR WET LOCATIONS.

3.6. USE 90 DEGREE BEN TO MAKE CHANGES IN DIRECTION. CONDUIT BODIES ARE NOT TO BE USED.

3.7. USE HYDRAULIC ONE-SHOT CONDUIT BENDER OR USE FACTORY 90 DEGREE BENDS FOR CONDUITS LARGER THAN 50MM (2").

3.8. AVOID MOISTURE TRAPS WHERE POSSIBLE; WHERE UNAVOIDABLE, PROVIDE JUNCTION BOX WITH DRAIN FITTING AT CONDUIT LOW POINT.

3.9. USE SUITABLE CONDUIT CAPS TO PROTECT INSTALLED CONDUITS AGAINST ENTRANCE OF DIRT AND MOISTURE.

3.10. PROVIDE #12AWG INSULATED CONDUCTOR OR SUITABLE PULL STRING IN EMPTY CONDUITS, EXCEPT SLEEVES AND NIPPLES.

3.11. INSTALL EXPANSION DEFLECTION JOINTS WHERE CONDUIT CROSSES BUILDING EXPANSION JOINTS.

3.12. CONCEAL CONDUITS IN ALL AREAS EXCEPT IN MECHANICAL AND ELECTRICAL ROOMS.

3.13. ALL CONDUITS SHALL BE INSTALLED PARALLEL TO BUILDING LINES AND BE SOLIDLY SUPPORTED FROM BUILDING STRUCTURE (I.E. SUPPORT FROM DUCTWORK, CEILING SYSTEM, ETC. IS NOT PERMITTED).

3.14. SEPARATE NEUTRALS AND GROUNDS SHALL BE PROVIDED FOR DATA POWER AND UPS POWER BRANCH CIRCUITS.

4. BOXES:

4.1. UNLESS OTHERWISE NOTED OR SPECIFIED HEREIN, INSTALL ALL OUTLETS FLUSH WITH FINISHED WALLS.

4.2. UNLESS OTHERWISE DIRECTED, ALL OUTLET BOXES SHALL BE ONE-PIECE FORMED, GALVANISED, CODE GAUGE STEEL. PLASTIC OR PVC TYPE BOXES ARE NOT ACCEPTABLE.

4.3. ENSURE THAT ALL BOXES FOR FLUSH OUTLETS, REGARDLESS OF LOCATION, EITHER HAVE THEIR OPENING FLUSH WITH FINAL WALL, FLOOR AND CEILING FINISHES, OR HAVE SUITABLE EXTENSION RINGS, DEVICE COVER OR PLASTER COVER EXTENDING TO THE OUTSIDE OF AND SET FLUSH WITH FINAL WALL, FLOOR AND CEILING FINISHES. UNLESS OTHERWISE INDICATED, INSTALL COVERS SO THAT WALL MOUNTED DEVICES WILL HAVE THEIR MOUNTING EARS VERTICAL.

4.4. COORDINATE THE WORK CAREFULLY WITH OTHER TRADES TO PROVIDE EASY ACCESS TO ALL JUNCTION AND PULLBOXES.

4.5. FOR MULTI-GANG FLUSH OUTLETS, USE MULTI-GANG BOXES WITH MULTI-GANG DEVICE COVERS OR SQUARE CORNERED TILE WALL COVERS (NOTE MAXIMUM 2-GANG FOR TILE BOXES) OF THE DEPTH REQUIRED. BOXES SHALL BE SUITABLE FOR FIELD INSTALLATION OF BARRIERS. DO NOT USE SECTIONAL BOXES.

4.6. ALL OUTLET, JUNCTION AND PULLBOXES SHALL BE COMPLETE WITH COVER.

5. SERVICE AND DISTRIBUTION:

5.1. GENERAL:

5.1.1. CONSULT THE LOCAL HYDRO COMPANY REGARDING ELECTRICAL SERVICES TO THE PROPOSED BUILDING. INCLUDE ALL COSTS LEVIED BY THE SUPPLY AUTHORITY TO PROVIDE ELECTRICAL SERVICES TO THE PROPERTY IN THE CONTRACT PRICE.

5.1.2. THE LOCAL SUPPLY AUTHORITY WILL PROVIDE AN INCOMING SERVICE AT 120/208V, 4 WIRE SERVICE.

5.1.3. PROVIDE A COMPLETE DISTRIBUTION SYSTEM AS DETAILED ON THE DRAWINGS.

5.1.4. ACCEPTABLE MANUFACTURERS OF DISTRIBUTION EQUIPMENT INCLUDE: EATON, SQUARE D OR SIEMENS.

5.2. BRANCH CIRCUIT PANELBOARDS:

5.1.1. MANUFACTURERS:

5.1.1.1. SIEMENS

5.1.1.2. SCHNEIDER / SQUARE D

5.1.1.3. EATON

5.1.1.4. SUBSTITUTION: NOT PERMITTED

5.1.2. DESCRIPTION: CSA 22.2 NO.9, CIRCUIT BREAKER TYPE, LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARD.

5.1.3. PANELBOARD BUS: ALUMINUM WITH RATINGS. PROVIDE GROUND BUS IN PANELBOARD. MINIMUM INTEGRATED SHORT CIRCUIT RATING AS INDICATED ON THE ELECTRICAL SINGLE LINE DIAGRAM. RATINGS SHALL BE BASED ON A FULLY-RATED SYSTEM.

5.1.4. MOULDED CASE CIRCUIT BREAKERS: NEMA AB 1, BOLT-ON TYPE THERMAL-MAGNETIC TRIP CIRCUIT BREAKERS, WITH COMMON TRIP HANDLE FOR ALL POLES, LISTED AS TYPE SWD FOR LIGHTING CIRCUITS, TYPE HACR FOR AIR CONDITIONING EQUIPMENT CIRCUITS, CLASS A GROUND FAULT INTERRUPTER BREAKERS WHERE SCHEDULED. DO NO USE TANDEM CIRCUIT BREAKERS.

5.1.5. ENCLOSURE: CSA TYPE 1.

5.1.6. CABINET BOX: 153MM (6") DEEP, 508MM (20"), HEIGHT AS DETERMINED BY NUMBER OF CIRCUITS AND WHETHER A MAIN CIRCUIT BREAKER IS REQUIRED.

5.1.7. CABINET FRONT: FLUSH CABINET FRONT WITH CONCEALED TRIM CLAMPS, DOOR-IN-DOOR CONCEALED HINGE, METAL DIRECTORY FRAME, AND FLUSH LOCK ALL KEYED ALIKE. FINISH IN MANUFACTURER STANDARD GRAY ENAMEL INSTALLATION.

5.1.8. INSTALL PANELBOARD TO CSA C22.1.

5.1.9. INSTALL PANELBOARD PLUMB. INSTALL RECESSED PANELBOARD FLUSH WITH WALL FINISHES.

5.1.10. HEIGHT: 1800MM (6') TO TOP OF PANELBOARD; INSTALL PANELBOARD TALLER THAN 1800MM (6') WITH BOTTOM NO MORE THAN 100MM (4") ABOVE FLOOR.

5.1.11. PROVIDE FILLER PLATES FOR UNUSED SPACES IN PANELBOARDS.

5.1.12. PROVIDE TYPED CIRCUIT DIRECTORY FOR EACH BRANCH CIRCUIT PANELBOARD. REVISE DIRECTORY TO REFLECT CIRCUITING CHANGES REQUIRED TO BALANCE PHASE LOADS.

5.1.13. COLOUR CODING OF CONDUCTORS SHALL BE MAINTAINED.

5.1.14. PROVIDE ENGRAVED PLASTIC NAMEPLATES.

5.1.15. EACH CIRCUIT BREAKER SHALL BE CHECKED FOR PROPER MANUAL OPERATION AND FOR TIGHTNESS OF ELECTRICAL CONNECTIONS.

5.1.16. UPON COMPLETION OF THE WORK AND IMMEDIATELY PRIOR TO SUBSTANTIAL PERFORMANCE, CHECK LOAD BALANCE ON FEEDERS AT PANELBOARD BY TURNING ON ALL POSSIBLE LOADS AND MEASURING LOAD FOR EACH PHASE AT EACH PANELBOARD. CORRECT LOAD IMBALANCES BY REARRANGING AND RECONNECTING CIRCUITS TO BALANCE THE PHASE LOADS TO WITHIN 15% BETWEEN EACH PHASE.

5.1.17. MAINTAIN PROPER PHASING FOR MULTI-WIRE BRANCH CIRCUITS.

6. WIRING DEVICES:

6.1. RECEPTACLES:

6.1.1. DUPLEX RECEPTACLES SHALL BE SPECIFICATION GRADE, CSA 5-15R, UNLESS OTHERWISE NOTED.

6.1.2. ACCEPTABLE MANUFACTURERS: HUBBELL, COOPER, LEVITON, PASS & SEYMOUR OR PRE-APPROVED EQUAL.

6.1.3. ALL RECEPTACLES SHALL BE OF ONE MANUFACTURER.

6.2. LIGHTING SWITCHES:

6.2.1. ALL LINE VOLTAGE SWITCHES SHALL BE SPECIFICATION GRADE, THREE-WAY OR AS INDICATED ON DRAWINGS.

6.2.2. ACCEPTABLE MANUFACTURERS: HUBBELL, COOPER, LEVITON, PASS & SEYMOUR OR APPROVED EQUAL.

6.2.3. ALL LIGHTING SWITCHES SHALL BE OF ONE MANUFACTURER.

6.3. COVER PLATES:

6.3.1. ALL COVER PLATES FOR FLUSH SWITCHES, RECEPTACLES, TELEPHONE OUTLETS, COMMUNICATION OUTLETS, ETC., SHALL BE THERMOPLASTIC, WHITE FINISH.

6.3.2. WHERE TWO OR MORE SWITCHES OR DEVICES ARE MOUNTED TOGETHER, THEY SHALL HAVE A COMMON COVERPLATES WITH OPENINGS TO SUIT RESPECTIVE DEVICES.

6.3.3. PLATES FOR OTHER DEVICES SHALL BE AS DESCRIBED ABOVE TO SUIT DEVICES.

6.3.4. STANDARD COVERPLATES SHALL BE AS MANUFACTURED BY ARROW-HART, BRYANT, SMITH AND STONE, PASS AND SEYMOUR OR HUBBELL.

6.4. ELECTRICAL SUPPORTING DEVICES:

6.4.1. ALL DEVICES, OUTLET BOXES AND RACEWAYS SHALL BE SOLIDLY FASTENED TO THE BUILDING IN A SECURE AND SOLID MANNER. RACEWAYS NOT EXPOSED TO VIEW SHALL BE FASTENED TO THE BUILDING STRUCTURE.

7. GROUNDING AND BONDING:

7.1. PROVIDE ALL GROUNDING TO CONFORM TO THE LATEST VERSION OF THE ONTARIO ELECTRICAL SAFETY CODE, WITH ANY FURTHER REQUIREMENTS AS NOTED HEREIN OR ON THE DRAWINGS.

7.2. PROVIDE SEPARATE AND PROPERLY SIZED GROUND WIRE AND FITTING FOR ALL FLEXIBLE CONDUIT CONNECTIONS.

7.3. EACH RECEPTACLE AND LIGHTING SWITCH SHALL HAVE A GROUNDING CONDUCTOR INSTALLED BETWEEN ITS GROUNDED OUTLET BOX AND THE GROUNDING TERMINAL ON THE RECEPTACLE.

7.4. PROVIDE INDIVIDUAL #6AWG GROUNDING CONNECTIONS TO ALL COMMUNICATION EQUIPMENT AND COMMUNICATION RACKS AND / OR CABINETS.

8. LUMINAIRES:

8.1. LUMINAIRES ARE INDICATED IN THE LUMINAIRE SCHEDULE BY MEANS OF TYPE LETTERS WHICH CORRESPOND TO SIMILAR LETTERS ON THE PLANS.

8.2. EFFECTIVELY GROUND ALL LUMINAIRES. LUMINAIRES WITH THEIR SOCKETS FAR ENOUGH APART AS TO GIVE LESS THAN PERFECT CONTACT AT LAMPS, OR WITH POOR GROUNDS, WILL BE REJECTED AND SHALL BE REPLACED BY THE CONTRACTOR WITHOUT CHARGE.

8.3. FOR EXACT LOCATIONS OF CEILING MOUNTED LUMINAIRES REFER TO ARCHITECTURAL REFLECTED CEILING PLANS.

8.4. EMERGENCY LIGHTING UNITS:

8.4.1. EMERGENCY LIGHTING UNITS SHALL BE FOR OPERATION AT 120 OR 347VAC C/W WITH SOLID STATE CHARGER, STATUS INDICATORS, SEALED MAINTENANCE-FREE LEAD-ACID 24VDC BATTERIES, APPROVED EQUAL OR AS INDICATED ON DRAWINGS.

8.4.2. EMERGENCY LIGHTING AND REMOTE HEADS AS INDICATED ON DRAWINGS.

8.4.3. BATTERY UNITS SHALL BE DIRECT CONNECTED TO LOCAL AREA LIGHTING CIRCUIT FOR AC BRANCH CIRCUIT FAILURE PROTECTION AS REQUIRED BY CODE.

8.5. EXIT SIGNS:

8.5.1. ENSURE THAT EXIT SIGN CIRCUIT BREAKER (DEDICATED CIRCUIT) IS LOCKED IN THE "ON" POSITION.

8.5.2. EXIT SIGNS SHALL BE ADEQUATELY SUPPORTED.

8.5.3. EXIT SIGNS SHALL LED TYPE (HIGH-OUTPUT, 120V). REFER TO SCHEDULE FOR SPECIFICATION DETAILS.

9. COMMUNICATIONS:

9.1. PROVIDE $\frac{3}{4}$"C WITH PULL CORD IN WALL CAVITY FROM DATA OUTLET LOCATION TO CEILING SPACE FOR DATA CABLING.

9.2. PROVIDE DATA CABLING FROM OUTLET LOCATION BACK TO SERVER RACK. FINAL TERMINATIONS AT RACK IS BY OTHERS.

9.3. COVERPLATES SHALL BE WHITE. ACCEPTABLE MANUFACTURES: HUBBELL, COOPER, LEVITON, PASS & SEYMOUR OR APPROVED EQUAL.

10. OCCUPANCY SENSOR

10.1. OCCUPANCY SENSORS SHALL PROVIDE THE FOLLOWING FEATURES

10.1.1. DUAL TECHNOLOGY ULTRASONIC/ INFRARED TYPE.

10.1.2. SUITABLE FOR MOUNTING ON A RECESSED OUTLET BOX

10.1.3. ADJUSTABLE INTERNAL TIME DELAY AND SENSITIVITY CONTROLS

10.1.4. TEMPERATURE AND HUMIDITY RESISTANT.

10.1.5. PROVIDE POWER PACKS TO CONTROL LOADS ASSOCIATED WITH CEILING OCCUPANCY SENSORS.

10.1.6. WHITE FINISH.

10.1.7. ACCEPTABLE MANUFACTURERS

10.1.7.1. WATTSTOPPER, HUBBELL

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR TENDER | SEPT 6'17 |
| 0 | ISSUED FOR OWNER REVIEW | AUG 25'17 |

**MIDDLESEX COUNTY**
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LICENSED PROFESSIONAL ENGINEER
17089
Sept 6'17
W.E. MOHAMED ALI
100136996
PROVINCE OF ONTARIO

PROJECT # 17089

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**SPECIFICATIONS -ELECTRICAL**

| | |
|---|---|
| DRAWN: TP | SCALE: N.T.S. |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E1.4 | REVISION: R1 |

**PHOTO 1: OVERALL SITE**

**PHOTO 3: EXISTING SALT SHED PANEL**

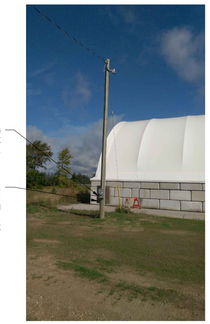


**PHOTO 2: EXISTING SALT SHED SERVICE**

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 0 | ISSUED FOR TENDER | SEPT 6'17 |

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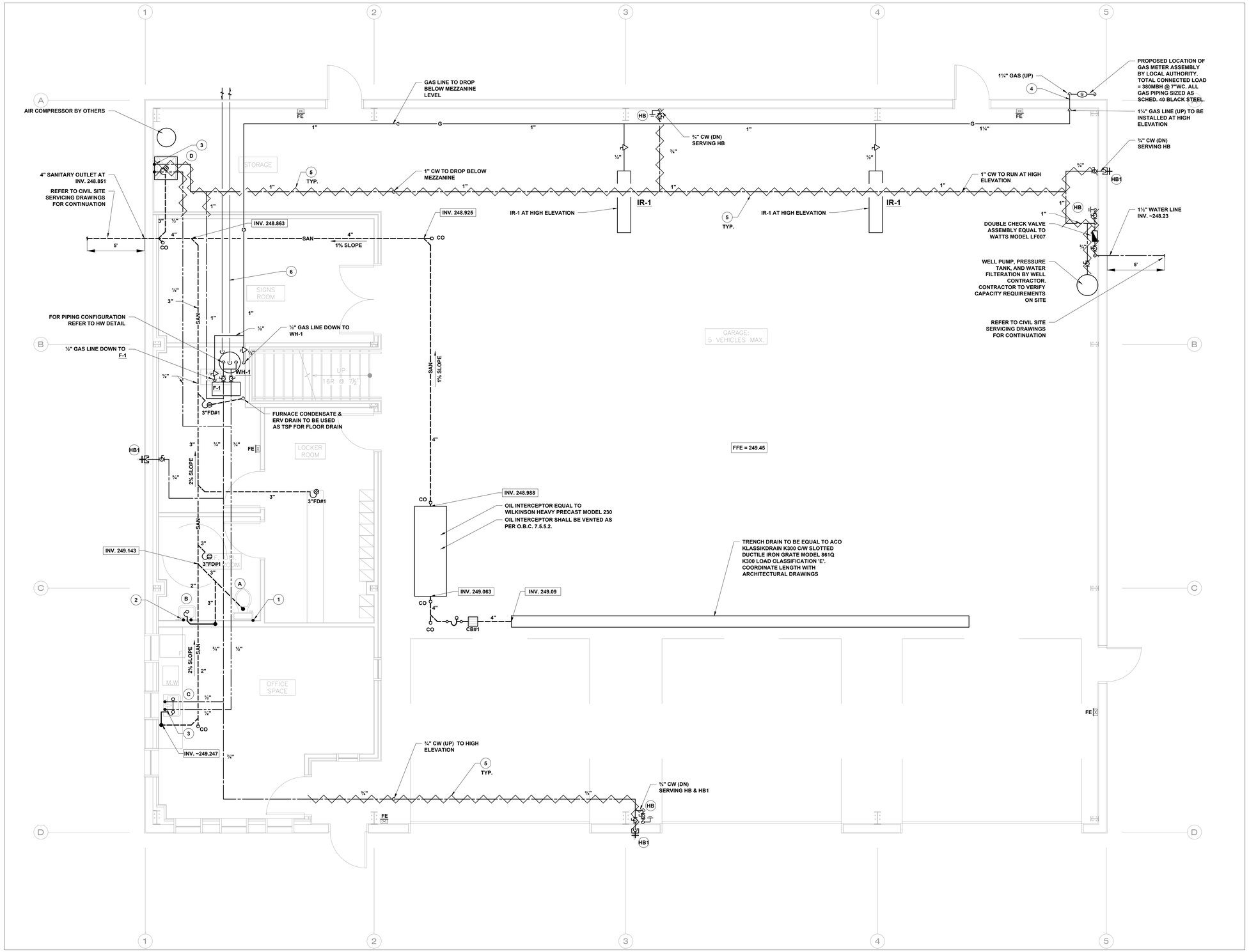
17089
Sept 6'17
WAEL MOHAMED ALI
100136996
PROVINCE OF ONTARIO

**PROJECT # 17089**

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
**STRATHROY ONTARIO**

**SITE PHOTOS**
**-ELECTRICAL**

| | |
|---|---|
| DRAWN: TP | SCALE: N.T.S. |
| DESIGN: TP | CHECKED: WA |
| DRAWING No. E1.5 | REVISION: R0 |




# MAIN FLOOR PLAN

SCALE: 1/4" = 1' - 0"

**DRAWING NOTES (DENOTED BY): #**

1. ½" COLD WATER TO WATER CLOSET.
2. 1¼" DRAIN, ½" HOT & COLD WATER LINES SERVING LAV.
3. ½" HOT & COLD WATER LINES SERVING SINK.
4. GAS LINE ENTERING BUILDING SHALL MEET GAS CODE SECTION 6.15.8.
5. ALL EXPOSED TRAPS & WET PIPING TO BE HEAT TRACED AND INSULATED. HEAT TRACE AND INSULATION BY MECHANICAL CONTRACTOR. CONNECTED BY ELECTRICAL CONTRACTOR. REFER TO DETAIL 1/M1.2.
6. VENT & COMBUSTION PIPES SERVING WH-1 TO BE ULC S636 PVC TERMINATE THROUGH WALL. FOR VENT SIZING AND LENGTHS REFER TO HOT WATER HEATER MANUFACTURER INSTALLATION INSTRUCTIONS.

**FIRE EXTINGUISHER SPECIFICATION**

1. PROVIDE ULC RATED 5LB. DRY CHEMICAL CLASS 2A:10B:C PORTABLE FIRE EXTINGUISHERS AS MANUFACTURED BY NFE C/W WALL MOUNTING BRACKET, IN ALL MECHANICAL ROOMS, ELECTRICAL ROOMS, GARBAGE ROOM AND WHERE INDICATED ON DRAWINGS AS PER ONTARIO FIRE CODE.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

**MIDDLESEX COUNTY**
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LICENSED PROFESSIONAL ENGINEER
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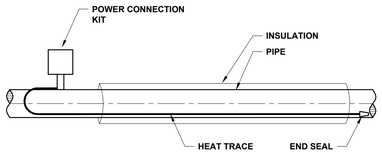
Sept 6 '17
V. T. W. LO
100148883
PROVINCE OF ONTARIO

PROJECT # 17089

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**MAIN FLOOR PLAN -PLUMBING**

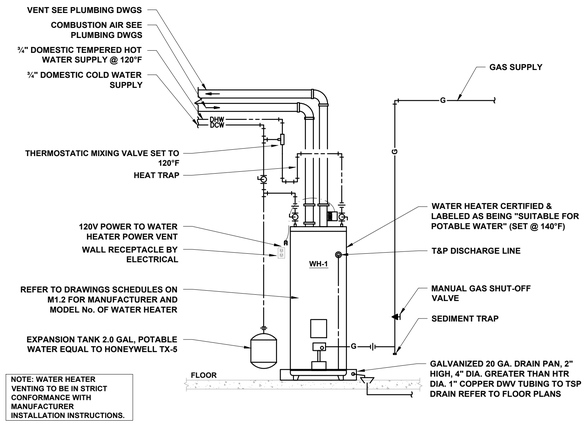
| | |
|---|---|
| DRAWN: TM | SCALE: 1/4" = 1' - 0" |
| DESIGN: TM | CHECKED: VL |
| DRAWING No. M1.1 | REVISION: R2 |




NOTES:

1. INCLUDE FOR ALL SPLICES, TEES, AND END SEALS REQUIRED.
2. MECHANICAL CONTRACTOR TO INSTALL CABLE AS PER MANUFACTURER INSTRUCTIONS.
3. MECHANICAL CONTRACTOR TO CONFIRM WITH THE HEAT TRACE MANUFACTURER THAT THE HEAT TRACE WATTAGE AND TYPE ARE APPLICABLE FOR USE WITH PIPE MATERIAL AND SIZE.
4. ACCEPTABLE MANUFACTURERS: BRITECH, RAYCHEM, HEATLINE, OR THERMON.

1 M1.2 **SELF-REGULATED HEAT TRACING**
**N.T.S.**




NOTE: WATER HEATER VENTING TO BE IN STRICT CONFORMANCE WITH MANUFACTURER INSTALLATION INSTRUCTIONS.

2 M1.2 **WH-1 HEATER CONFIGURATION**
**N.T.S.**

**DRAINAGE NOTES:**

1. THERE SHALL BE A CLEANOUT INSTALLED AT THE BASE OF EACH SANITARY STACK.
2. ALL DRAIN CONNECTIONS TO THE HORIZONTAL DRAIN AT BASE OF EACH STACK SHALL BE NOT LESS THAN 10'-0" FROM VERTICAL STACK.
3. ALL VENT CONNECTIONS TO OTHER VENTS SHALL BE MADE ABOVE THE HIGHEST FLOOD LEVEL RIM OF FIXTURES SERVED.
4. VTR SHALL INCREASE ONE PIPE SIZE, BUT NOT LESS THAN 3"° IMMEDIATELY BEFORE IT PENETRATES THE ROOF.
5. DRAINAGE WASTE AND VENT PIPING SHALL BE CAST IRON AND COPPER. PVC SYSTEM 15 IS ACCEPTABLE IF APPROVED BY THE OWNER AND JURISDICTION HAVING AUTHORITY FOR THE INTENDED APPLICATION.
6. PVC SYSTEM 15 DRAINAGE EXPANSION SHALL BE ACCOMMODATED BY CSA CERTIFIED RUBBER COUPLINGS INSTALLED EVERY SECOND FLOOR FOR VERTICAL PIPE RUNS OR AT APPROPRIATE INTERVALS FOR LONG HORIZONTAL RUNS AS REQUIRED BY MANUFACTURER.
7. PIPING AND FITTINGS LOCATED IN DROPPED CEILINGS OR POTENTIAL CONCEALED SPACES AS DESCRIBED IN O.B.C., 3.6.4.3.(1)(A) USED AS A RETURN AIR PLENUM TO BE PVC XFR, COPPER DWV, OR CAST IRON.
8. COMBINATION OF COMBUSTIBLE AND NON-COMBUSTIBLE DRAINAGE PIPING WILL NOT BE ACCEPTED.

**WATER PIPING NOTES:**

1. CPVC (AQUARISE) 1/2" - 4" PIPE SHALL BE ACCEPTED WITH THE FOLLOWING RESTRICTIONS. NO OTHER MANUFACTURERS OF CPVC ARE ACCEPTABLE.

- CPVC PIPE ID MUST MEET THE MINIMUM ID'S OF IPS SIZED SDR 11 PIPE.
- FOR 1-1/4" UP TO AND INCLUDING 4" PIPE SIZE:
  A. NO SPACING RESTRICTIONS.
- FOR 1/2" UP TO AND INCLUDING 1" FITTING SIZE:
  A. FITTINGS AND VALVES MUST HAVE A MINIMUM SPACING OF 5-1/2" ALONG THE PIPE.
  B. FITTINGS & VALVES ON ADJACENT PIPES WILL CONFORM TO LATERAL SPACING REQUIREMENTS ON THE PIPE.
- VALVES $\frac{3}{4}$" - 2" IN THE CPVC SYSTEM ARE TO BE CPVC (AQUARISE). 2-1/2" to 4" PIPE SIZES SHALL USE CPVC FLANGES WITH BUTTERFLY VALVES.
- INSTALLER SHALL DEBURR AND CHAMFER ENDS OF PIPE TO ENSURE PROPERLY GLUED CPVC CONNECTIONS.
- INSTALLER SHALL NOT USE PIPE DOPE UNLESS OTHERWISE APPROVED BY CPVC MANUFACTURER.
- INSTALLER SHALL CONSULT WITH THE CPVC PIPE MANUFACTURER PRIOR TO INSTALLATION FOR GUIDANCE WITH BUILDING CODE ISSUES, FIRESTOPPING, SUPPORT SPACING, ACCOMMODATION OF EXPANSION/CONTRACTION AND PROPER SOLVENT CEMENTING PROCEDURE.

2. PEX-a TUBING ½"-3" SHALL BE ACCEPTED WITH THE FOLLOWING RESTRICTIONS:

- FOR ½" UP TO AND INCLUDING 2" TUBE SIZE:
  A. PEX TUBING IN ALL CEILING SPACES AND BULKHEADS (PLENUM AND NON-PLENUM) OR EXPOSED SHALL BE INSTALLED WITH A MINIMUM SPACING OF 18" EXCEPT FOR THE FOLLOWING EXCEPTIONS:
     a. UPONOR WIRSBO ½"-2" PEX - MIN. SPACING 0"
     b. HEAT LINK ½" PEX - MIN. SPACING 8"

3. PEX-A TUBING 2-1/2" AND LARGER CAN ONLY BE USED IF CONCEALED WITHIN A WALL OR CONCRETE FLOOR SLAB, OR RATED INSULATION. RATED INSULATION MUST MEET SMOKE AND FLAME SPREAD RATINGS. REFER TO MANUFACTURER FOR REQUIREMENTS OF RATED INSULATION.
4. BALL VALVES ON ½" PEX TUBING TO BE FULL BORE DAHL 521LB-PRPX3-PRPX3 (PEX-F1960).
5. PEX & CPVC TUBING INSTALLED EXPOSED TO A UV LIGHT SOURCE (SUCH AS FLUORESCENT LIGHTS) MUST BE COVERED WITH INSULATION. REFER TO ELECTRICAL DRAWINGS.
6. COPPER PIPE ALL SIZES SHALL BE TYPE L COPPER.
7. COMBUSTIBLE PIPING IS NOT PERMITTED IN A VERTICAL SERVICE SPACE WHICH HAS A FIRE-RESISTANCE RATING OR FORMS A PART OF AN ASSEMBLY WHICH HAS A FIRE RESISTANCE RATING.

**GENERAL NOTES**

1. PLUMBING CONTRACTOR TO SUPPLY AND INSTALL ALL ACCESS DOORS (FIRE RATED AS REQUIRED) FOR ALL VALVE LOCATIONS INCLUDING SUITE VALVE LOCATIONS.
2. PROVIDE SHUT OFF VALVES AT ALL FINAL CONNECTIONS.
3. THE PLUMBING CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PLUMBING OPENINGS THROUGH FIRE-WALLS, INCLUDING APPROPRIATE SLEEVES AND FIRE CAULKING.
4. THE PLUMBING CONTRACTOR IS RESPONSIBLE FOR ALL PIPE EXPANSION COMPENSATION REQUIREMENTS FOR EACH PIPE MATERIAL USED. CONSULT WITH THE PIPE MANUFACTURER'S RECOMMENDATIONS FOR DEVICES AND METHODS TO BE USED.
5. REFER TO SPECIFICATION SECTIONS FOR INSULATION.

# PLUMBING FIXTURE SCHEDULE

| DRAWING REFERENCE | FIXTURE MAKE & MODEL | FIXTURE TRIM - MAKE & MODEL | CONNECTIONS | | | |
|---|---|---|---|---|---|---|
| | | | HOT | COLD | DRAIN | VENT |
| A | WATER CLOSET AMER.STD. 2467.100 'CADET' PRESSURE ASSIST, WHITE, ELONGATED BOWL. 4.2 LPF | SEAT: CENTOCO 820STS (OPEN FRONT WITH COVER)<br>SUPPLIES: MCGUIRE H166LKN3 FLOOR FLANGE, FLANGE BOLTS & NUTS | - | ½" | 3" | 1 ½" |
| B | SUITE WALL HUNG LAVATORY AMER. STD. MURRO 0954.000 SEMI-PED 0059.020 | FITTING: MOEN CHATEAU L4601 - MAX FLOW AT 5.7 LPM<br>TAILPIECE: McGUIRE 155A CP OPEN GRID WITH 1¼" TAILPIECE<br>TRAP: McGUIRE 8872C<br>SUPPLIES: McGUIRE H165LKN3RB<br>WASTE:<br>CARRIER: SMITH 700-M31 | ½" | ½" | 1 ¼" | 1 ¼" |
| C | SINGLE STAINLESS STEEL SINK WITH LEDGE BACK - KINDRED QSL-2020-7 LEDGE BACK SINK WITH SPILLWAY. BRIGHT MIRROR FINISH | FITTING: MOEN CHATEAU 7445 - CHROME ONE HANDLE FAUCET - MAX FLOW AT 5.7 LPM<br>TRAP: CAST BRASS 1-½", CLEANOUT, UNION ESCUTCH.<br>SUPPLIES: ANGLE STOPS, ESCUTCH, METAL RISERS | ½" | ½" | 1 ½" | 1 ¼" |
| D | JANITORS MOP RECEPTOR STERN WILLIAMS MTB-2424 | FITTING: AMERICAN STD. 8341.076.002 HERITAGE C/W T35 HOSE, T40 MOP HANGER,& 3" P-TRAP | ¾" | ¾" | 3" | 1 ½" |
| HB | INTERIOR HOSEBIBB | FITTING: FITTING: WATTS HB-1 c/w INTEGRAL VACUUM BREAKER | - | ¾" | - | - |
| HB1 | NON-FREEZE HOSEBIBB | FITTING: ZURN Z1315-VB c/w INTEGRAL VACUUM BREAKER | - | ¾" | - | - |
| | | | | | | |

NOTES:

1. ALL SANITARY VENTING TO BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF ONTARIO BUILDING CODE.
2. ALL FLOOR DRAINS TO BE TRAPPED, VENTED, AND PRIMED BELOW FLOOR.
3. ALL TUB AND SHOWER SPOUTS SHALL BE SUPPORTED BY WING BACK 90°.

## DRAIN SPECIFICATION

CB#1 DENOTES PARKING GARAGE CATCH BASIN EQUAL TO A WILKINSON HEAVY PRECAST GARAGE CATCH BASIN m/n CB120 COMPLETE WITH A CAST IRON GRATE. THE OUTSIDE DIMENSIONS OF THE CATCH BASIN ARE 585mm SQ. x 520mm DEEP.

FD#1 DENOTES FLOOR DRAIN EQUAL TO WATTS MODEL FD-100-C-3 (VANDAL PROOF) (ROUND) OR WATTS FD-100-C-L-3 (VANDAL PROOF) (SQUARE), CAST IRON BODY WITH ANCHOR FLANGE, POLISHED BRONZE ⅛" THICK STRAINER AND TSP TAPPING.

TRAP SEAL PRIMERS (NOT SHOWN ON DRAWINGS) TO BE INSTALLED ON COLD WATER SUPPLY PIPE OR A FIXTURE LOCAL TO THE DRAIN TRAP TO BE PRIMED. VACUUM BREAKER TO BE INTEGRAL TO THE PRIMER. TO BE INSTALLED AS PER PLUMBING CODE SECTION 7.4.5.5.

NOTE: PLUMBING CONTRACTOR TO CONFIRM CURRENT FLOOR / ROOF CONSTRUCTION AND COMPATIBILITY WITH MODEL NUMBER PRIOR TO ORDERING DRAINS.

## MAX. FIXTURE FLOW RATES

| FIXTURE | MAXIMUM FLOWRATES (AS PER OBC 2012 TABLES 7.6.4.1. & 7.6.4.2.A.) |
|---|---|
| LAVATORY FAUCET | 8.35 L/MIN (2.2 GPM) |
| KITCHEN FAUCET | 8.35 L/MIN (2.2 GPM) |
| TANK TYPE WATER CLOSET | 6 L / FLUSH 1.6 GPF) |
| NOTE: ENSURE THAT ALL FIXTURES ADHERE TO FIXTURE FLOW RATE SCHEDULE | |

# GAS FIRED WATER HEATER SCHEDULE

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | INPUT [MBH] | OUTPUT [MBH] | STORAGE CAPACITY [U.S.G] | RECOVERY 50°F-140°F [GPH] | DIMENSIONS | | | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | WIDTH [IN] | HEIGHT [IN] | SHIPPING WEIGHT [LBS] | |
| WH-1 | DOMESTIC HOT WATER | BRADFORD WHITE | RG2PDV40S6N | 40 | - | 40 | 38 | 30.5 | 60 | 161 | |

NOTES:

1. PROVIDE 3" CONCENTRIC VENT

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

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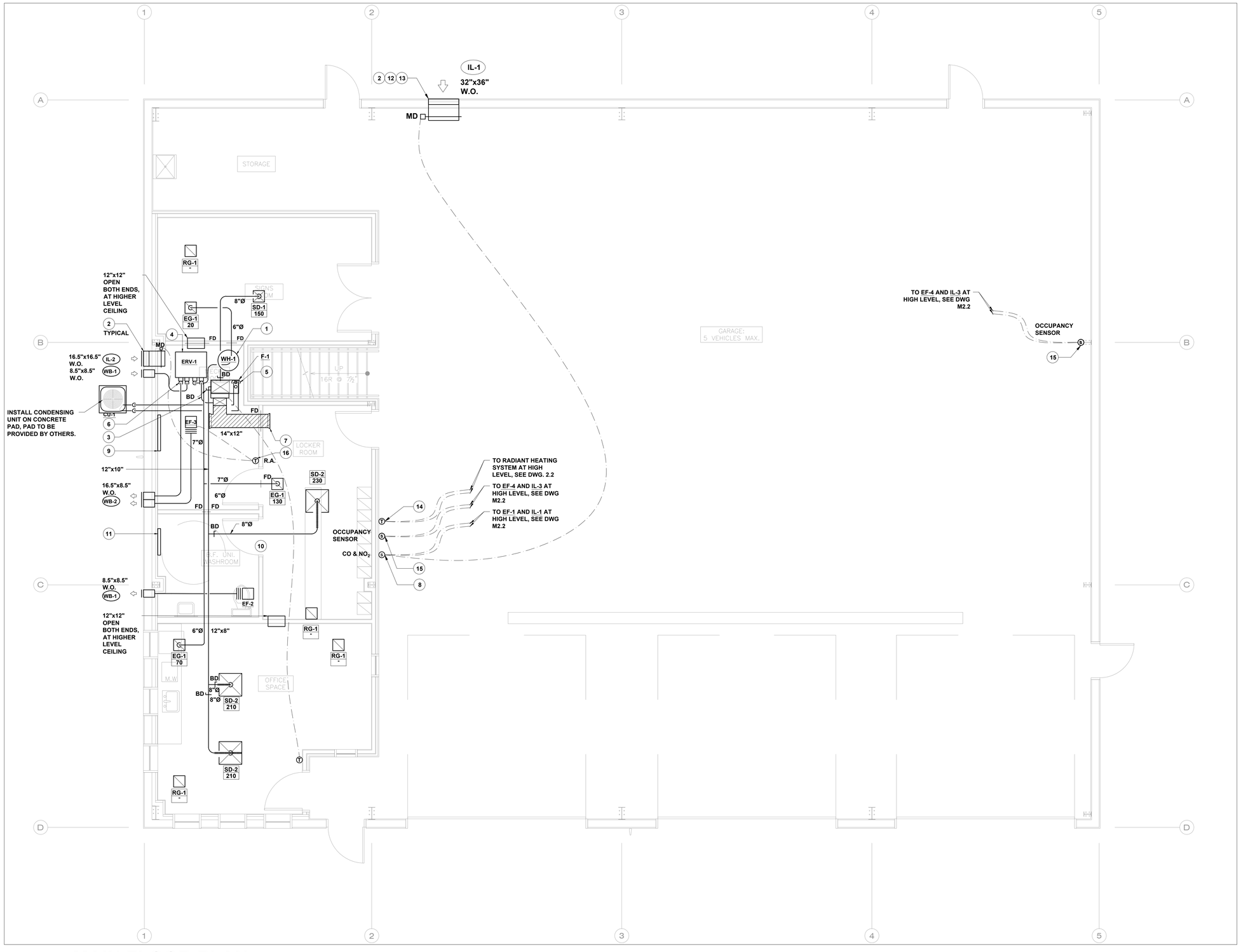
PROVINCE OF ONTARIO

PROJECT # 17089

**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**SCHEDULES & DETAILS -PLUMBING**

| | |
|---|---|
| DRAWN: TM | SCALE: N.T.S. |
| DESIGN: TM | CHECKED: VL |
| DRAWING No. M1.2 | REVISION: R2 |




# MAIN FLOOR PLAN

SCALE: 1/4" = 1' - 0"

**GENERAL NOTES:**

1. THESE DRAWINGS ARE TO BE USED IN CONJUNCTION WITH THE ARCHITECTURAL REFLECTIVE CEILING PLANS AND STRUCTURAL DRAWINGS.
2. FOR DIFFUSER DUCT SIZES REFER TO DIFFUSER SCHEDULE ON DRAWING M2.4. FOR GRILLE SIZES REFER TO GRILLE SCHEDULE ON DRAWING M2.4.
3. INTAKE/SUPPLY DUCT AND EXHAUST DUCT FROM ERV TO WALLBOX TO BE THERMALLY INSULATED.

EQUIPMENT NOTES (DENOTED BY): (#)

1. DOMESTIC HOT WATER HEATER. SEE DRAWING M1.1 FOR INSTALLATION DETAILS.
2. ALL EXTERIOR LOUVRES AND GRILLES ARE TO BE PAINTED BY THE MANUFACTURER. OBTAIN COLOUR CHIP FROM ARCHITECT. (TYPICAL FOR ALL)
3. EXTERNALLY INSULATE DUCTWORK. FROM ERV-1 TO F-1.
4. ERV-1 TO BE HUNG FROM CEILING, SITE VERIFY TO MEET MANUFACTURER'S SUGGESTED CLEARANCE. DUCTWORK CONNECTING TO ERV-1 TO BE SIZED BY THE MANUFACTURER.
5. REFRIGERANT PIPE FROM OUTSIDE CONDENSING UNIT, PIPING TO BE SIZED BY UNIT MANUFACTURER.
6. EXTERNALLY INSULATE EXHAUST AND INTAKE DUCT FROM EXTERIOR LOUVRE TO ERV.
7. OPEN ENDED DUCT AT HIGH LEVEL ABOVE T-BAR CEILING.
8. MECHANICAL CONTRACTOR TO PROVIDE CO AND $NO_2$ MONITORING SENSOR, C/W ASSOCIATED LOUVRE, MOTORIZED DAMPER, AND EXHAUST FAN. ELECTRICAL CONTRACTOR TO PROVIDE 120V WIRING AND POWER CONNECTIONS FROM CO AND $NO_2$ MONITORING SENSOR TO MOTORIZED DAMPERS ON IL-1, AND TO EXHAUST FAN EF-1. ELECTRICAL CONTRACTOR TO INTERLOCK FAN OPERATION AND DAMPER OPERATION.
9. ELECTRICAL CONTRACTOR TO PROVIDE ELECTRIC BASEBOARD HEATER, 0.75 KW, REFER TO ELECTRICAL DRAWINGS AND SPECIFICATION FOR DETAILS.
10. UNDERCUT DOOR MINIMUM 1/2".
11. ELECTRICAL CONTRACTOR TO PROVIDE ELECTRIC BASEBOARD HEATER, 0.5 KW, REFER TO ELECTRICAL DRAWINGS AND SPECIFICATION FOR DETAILS.
12. SIDEWALL LOUVRE C/W MOTORIZED DAMPER WITH ACTUATOR INTERLOCKED WITH EXHAUST FAN EF-1. MOUNTING HEIGHT TO BE LOCATED 24" A.F.F., EXACT LOCATION TO BE CONFIRMED ON SITE. MECHANICAL CONTRACTOR TO PROVIDE LOUVRE, MOTORIZED DAMPER, AND EXHAUST FAN. ELECTRICAL CONTRACTOR TO PROVIDE 120V WIRING AND POWER CONNECTIONS FROM CO AND $NO_2$ MONITORING SENSOR TO MOTORIZED DAMPERS ON IL-1, AND TO EXHAUST FAN EF-1. ELECTRICAL CONTRACTOR TO INTERLOCK FAN OPERATION AND DAMPER OPERATION.
13. MECHANICAL CONTRACTOR TO PROVIDE CO AND $NO_2$ MONITORING SENSOR, C/W ASSOCIATED LOUVRE, MOTORIZED DAMPER, AND EXHAUST FAN. ELECTRICAL CONTRACTOR TO PROVIDE 120V WIRING AND POWER CONNECTIONS FROM CO AND $NO_2$ MONITORING SENSOR TO MOTORIZED DAMPERS ON IL-1, AND TO EXHAUST FAN EF-1. ELECTRICAL CONTRACTOR TO INTERLOCK FAN OPERATION AND DAMPER OPERATION.
14. MECHANICAL CONTROCTOR TO PROVIDE 24V 7-DAY PROGRAMMABLE TSTAT, SET TO MAINTAIN TEMPERATURE AT 10°C.
15. ELECTRICAL CONTRACTOR TO PROVIDE OCCUPANCY SENSOR (LEVITON MODEL NO. OSSMT OR APPROVED EQUAL), 120V WIRING, AND POWER CONNECTION FROM OCCUPANCY SENSOR TO MOTORIZED DAMPER ON IL-2 AND TO EXHAUST FAN EF-4. INSTALLATION TO BE COORDINATED WITH FUTURE EQUIPMENT LAYOUT. ELECTRICAL CONTRACTOR TO INTERLOCK FAN OPERATION AND DAMPER OPERATION.
16. REVERSE ACTING TSTAT COMPLETE WITH ON-OFF SWITCH FOR OVERRIDE, INTERLOCKED WITH EXHAUST FAN EF-3. SET TO ACTIVATE WHEN TEMPERATURE REACHES 30°C. MECHANICAL CONTRACTOR TO PROVIDE EXHAUST FAN AND REVERSE ACTING TSTAT. ELECTRICAL CONTRACTOR TO PROVIDE 120V WIRING, AND POWER CONNECTION.

**THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.**

| No. | REVISION | DATE |
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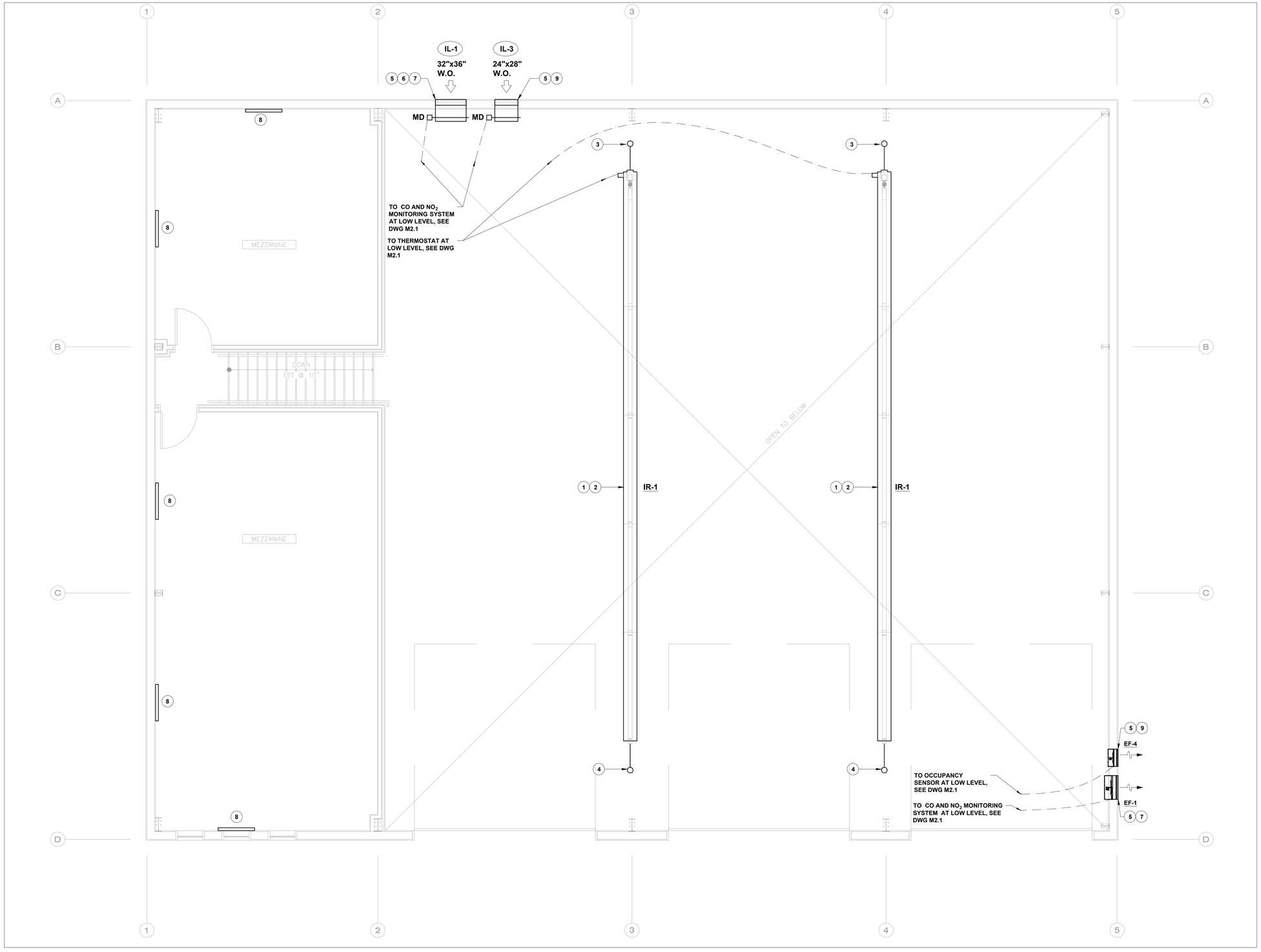
**MAIN FLOOR PLAN -HVAC**

| | |
|---|---|
| DRAWN: VL | SCALE: 1/4" = 1' - 0" |
| DESIGN: VL | CHECKED: VL |
| DRAWING No. M2.1 | REVISION: R2 |




# SECOND FLOOR PLAN

SCALE: 1/4" = 1' - 0"

**GENERAL NOTES:**

1. THESE DRAWINGS ARE TO BE USED IN CONJUNCTION WITH THE ARCHITECTURAL REFLECTIVE CEILING PLANS AND STRUCTURAL DRAWINGS.

**EQUIPMENT NOTES (DENOTED BY): (#)**

1. PROVIDE NEW GAS FIRED RADIANT TUBE HEATER, WIND AND RAIN HOOD, THERMOSTAT, PROVIDE STEEL HANGER KIT. INSTALL INFRARED HEATING ELEMENTS AS PER MANUFACTURERS RECOMMENDATIONS.
2. COORDINATE INSTALLATION OF HEATERS WITH LIGHTING. SEE ELECTRICAL DRAWINGS FOR LOCATIONS AND HEIGHTS.
3. 4" COMBUSTION AIR UP THROUGH ROOF. TERMINATE WITH VENT CAP AS PER MANUFACTURER RECOMMENDATIONS.
4. 4" VENT TERMINATION THROUGH ROOF. TERMINATE WITH VENT CAP AS PER MANUFACTURER RECOMMENDATIONS.
5. ALL EXTERIOR LOUVRES AND GRILLES ARE TO BE PAINTED BY THE MANUFACTURER. OBTAIN COLOUR CHIP FROM ARCHITECT. (TYPICAL FOR ALL)
6. PROVIDE NEW SIDEWALL LOUVRE C/W MOTORIZED DAMPER WITH ACTUATOR INTERLOCKED WITH EXHAUST FAN EF-1. EXACT MOUNTING HEIGHT AND LOCATION TO BE CONFIRMED ON SITE.
7. MECHANICAL CONTRACTOR TO PROVIDE CO AND $NO_2$ MONITORING SENSOR. ELECTRICAL CONTRACTOR 120V WIRING AND POWER CONNECTIONS FROM CO AND $NO_2$ MONITORING SYSTEM TO MOTORIZED DAMPERS ON IL-1, AND EXHAUST FAN EF-1.
8. ELECTRICAL CONTRACTOR TO PROVIDE 0.75 KW ELECTRIC BASEBOARD HEATER COMPLETE WITH BUILT-IN THERMOSTAT.
9. PROVIDE NEW SIDEWALL LOUVRE C/W MOTORIZED DAMPER WITH ACTUATOR INTERLOCKED WITH EXHAUST FAN EF-4. EXACT MOUNTING HEIGHT AND LOCATION TO BE CONFIRMED ON SITE.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

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STRATHROY ONTARIO

**SECOND FLOOR PLAN -HVAC**

| | |
|---|---|
| DRAWN: VL | SCALE: 1/4" = 1' - 0" |
| DESIGN: VL | CHECKED: VL |
| DRAWING No. M2.2 | REVISION: R2 |

# CONDENSING UNIT SCHEDULE

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | COOLING | | | | REFRIGERANT TUBING | | ELECTRICAL | | | | SOUND RATINGS [DB] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL CAPACITY [MBH] | SENSIBLE CAPACITY [MBH] | O.A.T [°F] | SEER | VAPOUR [IN. OD] | LIQUID [IN. OD] | V/Ph/Hz | RLA | MCA | MOCP | |
| CU-1 | F-1 | CARRIER | 24ACC524A003 | 23.4 | 18.6 | 95.0 | 14.0 | 3/4" | 3/8" | 208/1/60 | 10.9 | 14.1 | 20.0 | 71 |

NOTES:

1. SEE SPECIFICATIONS FOR ACCEPTABLE MANUFACTURERS
2. FOR TUBING SETS LONGER THAN 40FT (EQUIVALENT LENGHT), REFER TO THE MANUFACTURER'S GUIDELINES FOR REQUIRED TUBING SIZES, INSULATION THICKNESS AND ACCESSORIES.
3. ALL UNITS C/W R-410A REFRIGERANT

# ENERGY / HEAT RECOVERY VENTILATING UNIT SCHEDULE

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | PRESSURE DROP [IN.WG.] | | AIR VOLUME [CFM] | | SENSIBLE RECOVERY EFFICIENCY [HEATING] | ELECTRICAL | | WEIGHT [LBS] | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SUPPLY | EXHAUST | SUPPLY | EXHAUST | | V/Ph/Hz | AMPS | | |
| ERV-1 | OFFICE | VENMAR | X24ERV ECM-N | 0.3 | 0.3 | 220 | 220 | MINIMUM 61% AT 0°C/32°F | 115/1/60 | 2.0 | 26 | - C/W TIMER SWITCH PROVIDED BY MECHANICAL CONTRACTOR WIRED BY ELECTRICAL CONTRACTOR<br>- FANS TO RUN CONTINUOUS AT LOW SPEED AND UPON ACTIVATION OF TIMER FAN OR FURNACE TO RUN AT HIGH SPEED |

NOTES:

1. SEE SPECIFICATIONS FOR ACCEPTABLE MANUFACTURERS

# INFRARED HEATING UNITS

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | LENGTH [FT.] | INPUT CAPACITY [MBH] | FUEL | GAS CONNECTION | VENT SIZE | GAS INLET PRESSURE [IN.WG.] | ELECTRICAL [V/PH/HZ] | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IR-1 | GARAGE | SUPERIOR RADIANT PRODUCTS | AM-150 | 50'-0" | 90 - 150 | NATURAL GAS | 1/2" NPT | 4" | 5.3-14.0 | 120/1/60 | - C/W MODULATING THERMOSAT, 24V |

NOTES:

1. ALL INFRARED HEATERS TO BE MODULATING
2. PROVIDE THERMOSTATS AND CONTROL PANEL AS SHOWN ON DRAWINGS

# WALLBOX & LOUVRE SCHEDULE

| DRAWING REFERENCE | MANUFACTURER | MODEL NO. | TYPE | SIZE [LxW] | REMARKS |
|---|---|---|---|---|---|
| WB-1 | REVERSOMATIC | SWBL-8 | EXHAUST | 8"x8" | SINGLE WALL BOX |
| WB-2 | REVERSOMATIC | DWBL-8 | EXHAUST | 16"x8" | DOUBLE WALL BOX |
| IL-1 | VENTEX | 2435 | INTAKE | 32"x36" | 4" DEEP, DRAINABLE |
| IL-2 | VENTEX | 2435 | INTAKE | 16"x16" | 4" DEEP, DRAINABLE |
| IL-3 | VENTEX | 2435 | INTAKE | 24"x28" | 4" DEEP, DRAINABLE |

NOTES: SEE SPECIFICATIONS FOR ACCEPTABLE MANUFACTURERS

# MECHANICAL LEGEND

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| CWS | CHILLED WATER SUPPLY PIPING | | IN-LINE PUMP | | EXISTING DUCTWORK - SINGLE LINE | SD-1 / 130 | GRILLE REFERENCE (SEE GRILLE AND DIFF. SCHED. FOR MODEL AND SIZE)<br>AIR CAPACITY [CFM] |
| CWR | CHILLED WATER RETURN PIPING | G | GAS METER | | NEW DUCTWORK - SINGLE LINE | | |
| HWS | HEATING SUPPLY PIPING | M | WATER METER | | DUCTWORK TO BE REMOVED - SINGLE LINE | WB-1 | WALL BOX OR LOUVRE REFERENCE (SEE GRILLE AND DIFF. SCHED. FOR MODEL AND SIZE) |
| HWR | HEATING RETURN PIPING | AAV | AUTO AIR VENT | | NEW DUCTWORK - DOUBLE LINE | H# | HEATING RISER # |
| HPS | HEAT PUMP SUPPLY PIPING | MAV | MANUAL AIR VENT | | EXISTING DUCTWORK - DOUBLE LINE<br>DUCTWORK TO REMAIN | C# | CONDENSATE RISER # |
| HPR | HEAT PUMP RETURN PIPING | | DRAIN | | EXISTING DUCTWORK - DOUBLE LINE<br>DUCTWORK TO BE REMOVED | M# | MAKE-UP AIR RISER # |
| LIQ | LIQUID REFRIGERATION LINE | | CAP | | EXTERNALLY INSULATED DUCTWORK | 1 | DRAWING NOTES |
| SUC | SUCTION REFRIGERATION LINE | | WELL | | INTERNALLY INSULATED DUCTWORK | | NEW DIFFUSER NOTES |
| STM | STEAM PIPING | F.S. | FLOW SWITCH | F.D. | FIRE DAMPER | | SQUARE CONE DIFFUSER (ROUND IF SHOWN)<br>DUCT COLLAR CONNECTION SIZE AS PER GRILLE AND DIFFUSER SCHEDULE<br>FLEXIBLE DUCT - MAX. 6'-0" (1.8M)<br>DIFFUSER SUPPLY DUCT - TO BE THE SAME SIZE AS DIFFUSER COLLAR<br>BALANCE DAMPER - TYPICAL AT ALL DIFFUSER SUPPLIES<br>SUPPLY DUCT |
| COND | CONDENSATE PIPING | | TEMPERATURE GAUGE | M.D. | MOTORIZED DAMPER | | |
| | EXISTING SUPPLY PIPING TO BE REMOVED | | PRESSURE GAUGE | B.D. | BALANCING DAMPER | | |
| | EXISTING RETURN PIPING TO BE REMOVED | T | THERMOSTAT | B.D.D. | BACK DRAFT DAMPER | | |
| SAN | SANITARY PIPING | H | HUMIDISTAT | SPD | SPLITTER DAMPER | | |
| SAN | SANITARY PIPING (BURIED) | S | SENSOR | S | FAN SPEED CONTROLLER | | |
| ST | STORM PIPING | S | SENSOR | | NEW CONNECTION TO EXISTING DUCTS | | |
| ST | STORM PIPING (BURIED) | | NEW CONNECTION TO EXISTING PIPES | | NEW SUPPLY AIR GRILLE | | |
| | DOMESTIC COLD WATER PIPING | | DRAIN HOSE CONNECTION | | NEW RETURN AIR GRILLE | | |
| | DOMESTIC HOT WATER PIPING | | TRIPLE DUTY VALVE | | EXISTING SUPPLY AIR GRILLE TO REMAIN<br>RELOCATE AS INDICATED TO SUIT LAYOUT | | |
| | DOMESTIC HOT WATER RECIRC PIPING | | ELEC. SUPERVISED O.S. & Y VALVE | | EXISTING RETURN AIR GRILLE TO REMAIN<br>RELOCATE AS INDICATED TO SUIT LAYOUT | | |
| | VENT PIPING | BFP | DOUBLE CHECK VALVE ASSEMBLY | | EX. SUPPLY AIR GRILLE TO BE REMOVED | | |
| G | GAS PIPING | BFP | D.C.V.A. REDUCED PRESSURE PRINCIPLE | | EX. RETURN AIR GRILLE TO BE REMOVED | | |
| EG | EMERGENCY GAS PIPING | HB | HOSE BIB | | SIDEWALL GRILLE C/W BALANCE DAMPER<br>TYPICAL AT ALL SIDEWALL GRILLES | | |
| | ISOLATION VALVE | HB1 | NON-FREEZE HOSE BIB | | | | |
| | BALANCING/ISOLATION VALVE | CO | FLOOR CLEAN OUT | | | | |
| | TRIPLE DUTY VALVE | CO | AREA CLEAN OUT | | | | |
| | GATE VALVE | CO | RUNNING TRAP c/w HANDHOLES ON EACH SIDE | | | | |
| | BALL VALVE | CB | CATCH BASIN | | | | |
| | BUTTERFLY VALVE | RD | ROOF DRAIN | | | | |
| | GLOBE VALVE | FD | FLOOR DRAIN | | | | |
| | 2-WAY CONTROL VALVE | HD | HUB DRAIN | | | | |
| | 3-WAY CONTROL VALVE | CD | COMBINATION DRAIN | | | | |
| | CHECK VALVE | SCD | SCUPPER DRAIN | | | | |
| | FLEXIBLE CONNECTOR | VTR | VENT THROUGH ROOF | | | | |
| | BACKFLOW PREVENTER | | FIRE EXTINGUISHER | | | | |
| | PRESSURE REDUCING VALVE | (FA) | FROM ABOVE | | | | |
| | CIRCUIT SETTER VALVE | (FB) | FROM BELOW | | | | |
| | GAS COCK (SHUT OFF VALVE) | (DN) | DOWN | | | | |
| | TEMPERATURE & PRESSURE RELIEF VALVE | (UP) | UP | | | | |
| | STRAINER | HP / LP | HIGH PRESSURE / LOW PRESSURE | | | | |
| | UNION | | | | | | |

THIS IS A STANDARD LEGEND. ALL TAGS MAY NOT NECESSARILY BE USED ON DRAWINGS.

# FURNACE SCHEDULE

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | AIR FLOW [CFM] | EXTERNAL STATIC PRESSURE [IN.WC.] | FUEL | INPUT [MBH] | OUTPUT [MBH] | ELECTRICAL | | | CONNECTIONS | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | V/P/H | MCA | MOP | GAS | VENT | |
| F-1 | OFFICE | CARRIER | 59SC5A040S14-10 | 800 | 0.1 | NATURAL GAS | 40.0 | 39.0 | 115/1/60 | 6.8 | 15.0 | 3/4 | 6 | SUPPLIED WITH A 24V 7-DAY PROGRAMMABLE THERMOSTAT AND A SIDE FILTER RACK. FURNACE TO BE UPFLOW SUPPLY, SIDE RETURN. |

NOTES: SEE SPECIFICATIONS FOR ACCEPTABLE MANUFACTURERS

# FAN SCHEDULE

| DRAWING REFERENCE | SERVICE | MANUFACTURER | MODEL | TYPE | AIR FLOW [CFM] | EXTERNAL STATIC PRESSURE [IN.WG.] | FAN RPM | MOTOR | | | ACCESSORIES | MOUNTING | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | MOTOR HP | V/PH/HZ | RPM | | | |
| EF-1 | GARAGE EXHAUST FAN | GREENHECK | SBE-1L20-4 | SIDEWALL PROPELLER | 3325.0 | 0.125 | - | 0.25 | 120/1/60 | 810 | 9,12,14,17 | WALL | C/W WALL HOUSING MOUNTING AND ASSOCIATED ACCESSORIES, INTERLOCKED WITH INTAKE MOTORIZED DAMPERS, CONTROLLED BY CO AND $NO_2$ MONITORING SENSOR |
| EF-2 | WASHROOM EXHAUST FAN | BROAN | DX-110 | CEILING CABINET | 100.0 | 0.2 | - | FHP | 120/1/60 | - | 1,2,5 | CEILING | CONTROLLED BY LIGHT SWITCH/OCCUPANCY SENSOR |
| EF-3 | MECHANICAL ROOM EXHAUST FAN | GREENHECK | SP-A200 | CEILING CABINET | 224.0 | 0.25 | - | FHP | 120/1/60 | - | 1,2,5 | CEILING | CONTROLLED BY REVERSE-ACTING THERMOSTAT, INTERLOCKED WITH INTAKE MOTORIZED DAMPER, PROVIDE OVERRIDE SWITCH |
| EF-4 | WORKSHOP EXHAUST FAN | GREENHECK | SE1-12-426-D | SIDEWALL PROPELLER | 930.0 | 0.125 | - | 0.1 | 120/1/60 | - | 12,17 | WALL | C/W WALL HOUSING MOUNTING AND ASSOCIATED ACCESSORIES, INTERLOCKED WITH INTAKE MOTORIZED DAMPERS, CONTROLLED BY OCCUPANCY SENSOR |

ACCESSORIES:

| | | | |
|---|---|---|---|
| 1. HANGER RODS | 6. INDICATE ROOF CURB TO BE PROVIDED BY GENERAL CONTRACTOR AS DETAILED ON ARCHITECTURAL DWGS. | 11. TRANSFORMER AND RELAY FOR 24V CONTROL | 16. DRAIN CONNECTION |
| 2. HANGING VIBRATION ISOLATORS | 7. ROOF CURB BY FAN MANUFACTURER | 12. WEATHER HOOD | 17. MATCHING EXT. WALL LOUVRE W/ BIRDSCREEN AND B.D.D. |
| 3. BASE ISOLATOR KIT | 8. DISCONNECT SWITCH | 13. WALL MOUNT COLLAR | 18. SOLID STATE SPEED CONTROL (MOUNTED IN FAN HOUSING) BELT DRIVE MOTOR COVERS |
| 4. FLEXIBLE CONNECTIONS - INLET AND OUTLET | 9. BELTS, DRIVES AND PULLEYS | 14. BELT DRIVE MOTOR COVERS | 19. CONTROL PANEL |
| 5. BACKDRAFT DAMPER | 10. ACCESS DOOR | 15. INSULATED HOUSING | |

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 2 | ISSUED FOR TENDER | SEPT 6'17 |
| 1 | ISSUED FOR OWNER REVIEW | AUG 25'17 |
| 0 | ISSUED FOR COORDINATION | AUG 18'17 |

**MIDDLESEX COUNTY**
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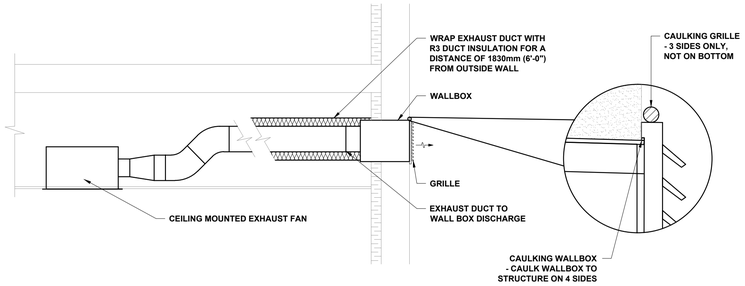
LICENSED PROFESSIONAL ENGINEER
17089
Sept 6 '17
V. T. W. LO
100148883
PROVINCE OF ONTARIO

PROJECT # 17089

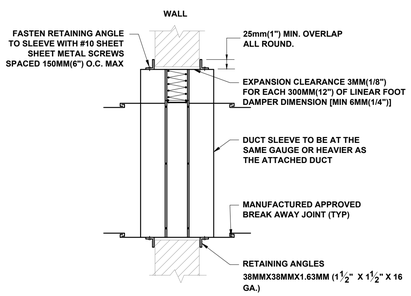
**PUBLIC WORKS GARAGE**
**3550 EGREMONT DRIVE**
STRATHROY ONTARIO

**SCHEDULES & DETAILS -HVAC**

| | |
|---|---|
| DRAWN: VL | SCALE: N.T.S. |
| DESIGN: VL | CHECKED: VL |
| DRAWING No. M2.3 | REVISION: R2 |

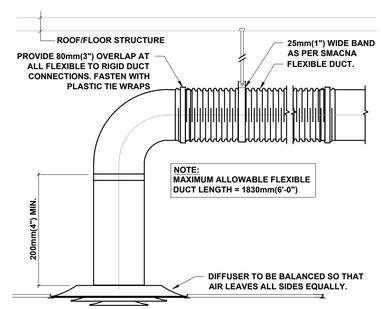



**TYPICAL CEILING EXHAUST FAN TO WALL BOX DETAIL**
N.T.S.

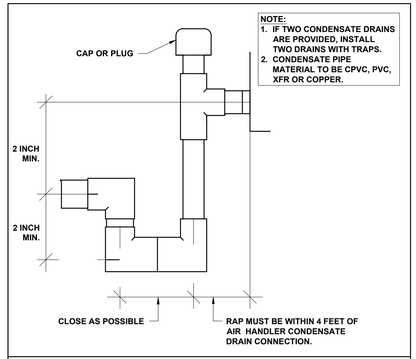



**VERTICAL MOUNT DETAIL**

**FIRE DAMPER DETAIL**
N.T.S.




**CEILING DIFFUSER INSTALLATION DETAIL**
N.T.S.




**FURNACE CONDENSATE TRAP DETAIL**
N.T.S.

# GRILLE & DIFFUSER SCHEDULE

| DRAWING REFERENCE | MANUFACTURER | MODEL | PANEL SIZE | NECK SIZE | AIR RANGE [CFM] | REMARKS |
|---|---|---|---|---|---|---|
| SD-1 / CFM | E.H.PRICE | SCD/B12 | 12"x12" | 8"Ø | 0-200 | SUITABLE FOR T-BAR INSTALLATION. WHITE FINISH. |
| SD-2 / CFM | E.H.PRICE | SCD/B12 | 24"x24" | 8"Ø | 150-300 | SUITABLE FOR T-BAR INSTALLATION. WHITE FINISH. |
| RG-1 / CFM | E.H.PRICE | 80/TB/B12 | 12"X12" | - | 0-1000 | SUITABLE FOR T-BAR INSTALLATION. WHITE FINISH. |
| EG-1 / CFM | E.H.PRICE | 530D/TB/B12 | 12"x12" | - | 0-200 | WHITE FINISH. SUITABLE FOR T-BAR INSTALLATION. C/W BALANCING DAMPER. |

NOTES:
1. SEE SPECIFICATIONS FOR ACCEPTABLE MANUFACTURERS
2. ALL BRANCH DUCTWORK SERVING DIFFUSERS TO BE THE SAME SIZE AS DIFFUSER NECK UNLESS SPECIFIED OTHERWISE
3. THIS IS A STANDARD LEGEND, ALL SYMBOLS MAY NOT BE USED ON DRAWINGS .

# CO & $NO_2$ SYSTEM EXHAUST RATE

| | |
|---|---|
| 1. | OVERALL SYSTEM AREA - 3960 SQ.FT (367.9 SQUARE METER) |
| 2. | ASHRAE 62.1-2010 STATES THE FOLLOWING FOR THE SYSTEM: 0.75 CFM/SQ.FT X 3960 SQ.FT = 2970 CFM |
| 3. | TOTAL REQUIRED EXHAUST RATE = 2970 CFM |
| 4. | CO & $NO_2$ SYSTEM IS DESIGNED FOR STORAGE GARAGE USAGE ONLY, THE ENGINE MUST BE SHUT OFF WHEN VEHICLES ARE NOT IN MOTION. |
| 5. | CO & $NO_2$ SYSTEM IS DESIGNED FOR ELECTRIC FORKLIFT OPERATIONS ONLY, OPERATIONS OF PROPANE OR GAS FUELED FORKLIFTS ARE PROHIBITED. |

# OFFICE VENTILATION SCHEDULE

| | |
|---|---|
| 1. | ANCILLARY SPACE OVERALL AREA - 918 SQ.FT (85.3 SQUARE METER) |
| 2. | ASHRAE 62.1-2010 STATES THE FOLLOWING:<br>- FOR OFFICE:<br>5 CFM/PERSON x 9 PPL = 45 CFM<br>0.06 CFM/SQ.FT X 246 SQ.FT = 15 CFM<br>TOTAL REQUIREMENT = 60 CFM<br>- FOR DRY STORAGE:<br>5 CFM/PERSON x 1 PPL = 5 CFM<br>0.06 CFM/SQ.FT X 204 SQ.FT = 15 CFM<br>TOTAL REQUIREMENT = 20 CFM |
| 3. | TOTAL VENTILATION REQUIREMENT = 80 CFM |

# WORKSHOP VENTILATION SCHEDULE

| | |
|---|---|
| 1. | WORKSHOP OVERALL AREA - 3960 SQ.FT (367.9 SQUARE METER) |
| 2. | ASHRAE 62.1-2010 STATES THE FOLLOWING FOR WOOD/METAL SHOP:<br>10 CFM/PERSON x 10 PPL = 100 CFM<br>0.18 CFM/SQ.FT X 368 SQ.FT = 715 CFM |
| 3. | TOTAL VENTILATION REQUIREMENT = 815 CFM |

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LICENSED PROFESSIONAL ENGINEER 17089 Sept 6'17 V.T.W. LO 100148863 PROVINCE OF ONTARIO

PROJECT # 17089

**PUBLIC WORKS GARAGE**
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**SCHEDULES & DETAILS -HVAC**

| | |
|---|---|
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| DESIGN: VL | CHECKED: VL |
| DRAWING No. M2.4 | REVISION: R2 |

# MECHANICAL SPECIFICATIONS

## 1. GENERAL

A. LABOR, MATERIALS AND FEES
- PROVIDE ALL LABOR AND NEW MATERIALS FOR THE COMPLETE INSTALLATION OF THE SYSTEMS AS SHOWN ON THE DRAWINGS. ENSURE THAT COMPLETE INSTALLATION MEETS WITH THE APPROVAL OF ALL AUTHORITIES HAVING JURISDICTION IN ACCORDANCE WITH ALL CODES, ETC.
- ARRANGE AND PAY FOR ALL PERMITS AND FEES REQUIRED FOR THIS INSTALLATION.
- USE MATERIALS THAT ARE C.S.A., U.L.C. APPROVED AND C.G.A. OR ONTARIO HYDRO CERTIFIED FOR THE INTENDED APPLICATION.

B. EXAMINE THE SITE
- EXAMINE THE SITE AND BE FAMILIAR WITH ALL THE CONDITIONS COVERED BY THESE SPECIFICATIONS. EXTRAS WILL NOT BE ALLOWED FOR FAILURE TO PROPERLY EVALUATE CONDITIONS.
- TAKE FIELD DIMENSIONS PRIOR TO ANY INSTALLATION.

C. COMPLIANCE WITH CODES
- COMPLY WITH ALL LATEST RELEVANT CODES AND LOCAL REGULATIONS HAVING JURISDICTION INCLUDING O.B.C., N.B.C., N.F.P.A., C.G.A., O.W.R.A. 675/85, CSA, CANADIAN PLUMBING CODE, AND ANDOESC (CSA C22.1-12)

D. DEBRIS AND CLEAN-UP
- KEEP PREMISES CLEAN AS WORK PROGRESSES AND AVOID ACCUMULATION OF DEBRIS ON COMPLETION OF THE WORK, CLEAN-UP AND REMOVE FROM SITE ALL SCRAP MATERIALS RESULTING FROM THE WORK.
- CLEAN ALL EQUIPMENT PRIOR TO FINAL INSPECTION.

E. CO-ORDINATION AND CO-OPERATION
- CO-ORDINATE THE WORK WITH ALL TRADES TO ENSURE WORK MAY PROGRESS WITHOUT DELAY. ARRANGE THE SCHEDULE OF ALL WORK IN CO-OPERATION WITH THE GENERAL CONTRACTOR.
- CO-ORDINATE THE WORK WITH ALL TRADES AND CO-OPERATE TO ENSURE SERVICES DO NOT CONFLICT WITH OTHER SERVICES AND/OR STRUCTURE.
- DRAWINGS INDICATE GENERAL DESIGN LAYOUT ONLY. THEY ARE TO SOME EXTENT DIAGRAMMATIC. MAKE ALLOWANCES FOR SUCH ITEMS AS OFFSETS TO ACCOMMODATE ACTUAL FIELD CONDITIONS. REFER TO STRUCTURAL AND ARCHITECTURAL DRAWINGS FOR FURTHER BUILDING INFORMATION.

F. WARRANTY
- GUARANTEE ALL WORK, EQUIPMENT AND MATERIALS FOR ONE YEAR FROM SUBSTANTIAL COMPLETION OF THE CONTRACT.
- ENSURE THAT ALL EQUIPMENT IS PROPERLY GUARANTEED BY THE MANUFACTURER.

G. SHOP DRAWINGS
- SUBMIT SHOP DRAWINGS OF ALL FIXTURES AND EQUIPMENT (INCLUDING WIRING DIAGRAMS) TO THE CONSULTANT FOR APPROVAL. APPROVAL OF SHOP DRAWINGS IS GRATUITOUS AND DOES NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITIES.
- PROVIDE SHOP DRAWING FOR THE FOLLOWING:
  a. FANS (SUPPLY AND EXHAUST)
  b. GRILLES, DIFFUSERS, WALL BOXES, LOUVERS
  c. WATER HEATERS AND TANKS
  d. PUMPS (HVAC AND PLUMBING)
  e. FURNACES AND CONDENSING UNITS
  f. ERV UNITS
  g. INFRARED HEATERS
  h. MOTORIZED DAMPERS
  i. PLUMBING FIXTURES AND TRIM
  j. PLUMBING SPECIALTIES
  k. CONTROLS (IF APPLICABLE)

H. CUTTING AND PATCHING
- PROVIDE CUTTING AND PATCHING FOR THIS WORK.
- ARRANGE TO PROVIDE MAKING GOOD TO FINISHES AND INCLUDE FOR THE COST OF THIS WORK.

I. PIPING INSTALLATION
- ALL PIPING IS TO BE INSTALLED WITH ADEQUATE CHANGE OF DIRECTION, EXPANSION JOINTS AND ANCHORS, SO THAT THE PIPING AND EQUIPMENT WILL IN NO WAY BE STRAINED OR DISTORTED BY EXPANSION AND CONTRACTION.

J. WIRING
- ALL POWER WIRING: ELECTRICAL SPECIFICATIONS.
- 24 VOLT WIRING ONLY: MECHANICAL SPECIFICATIONS.
- INCLUDE FOR ALL NECESSARY STARTERS, DISCONNECTS, TRANSFORMERS AND RELAYS ETC. FOR ALL EQUIPMENT SUPPLIED UNDER THIS DIVISION.
- ENSURE CO-ORDINATION BETWEEN TRADES TO AVOID GAPS AND OVERLAPS AND TO ENSURE ALL EQUIPMENT IS OPERATIONAL.

J. DEMONSTRATION
- ALLOW FOR DEMONSTRATION OF ALL EQUIPMENT TO THE OWNER AND THE OWNER'S OPERATING STAFF.

K. MISCELLANEOUS STEEL
- PROVIDE STRUCTURAL STEEL, SUPPORT MEMBERS AS NECESSARY TO HANG EQUIPMENT, FANS, DUCTWORK, AND PIPEWORK FROM BUILDING STRUCTURE.
- PAINT ALL MISCELLANEOUS BARE METAL ONE COAT GREY OXIDE PRIMER.

L. ALTERNATIVES
- NO DEVIATION FROM PLANS AND SPECIFICATIONS WILL BE ALLOWED UNLESS WRITTEN APPROVAL AND CONSENT IS FIRST OBTAINED FROM THE CONSULTANT OR OWNER.
- ASSUME FULL RESPONSIBILITY THAT THE EQUIPMENT OFFERED AS AN ALTERNATIVE IS SUITABLE FOR THE SPACE ALLOCATED, AND FOR ANY ADDITIONAL COSTS TO ANY PART OF THE WORK RESULTING FROM THE USE OF AN ALTERNATE.

M. MAINTENANCE AND OPERATING INSTRUCTIONS
- PROVIDE THREE COPIES OF MANUFACTURERS' MAINTENANCE AND OPERATING INSTRUCTIONS FOR ALL EQUIPMENT.
- PRESENT THE INSTRUCTION IN INDEXED THREE RING HARD COVER BIDDERS, WITH SPINE LABEL PROJECT INDICATOR, AND INDEX SHEET.
- INCLUDE ALL SHOP DRAWINGS, PERMITS, WARRANTY DETAILS, CERTIFICATES AND CONTRACTOR NAMES AND TELEPHONE NUMBER LISTS FOR ALL PROJECT TRADES IN THIS MANUAL.

N. ASHRAE 90.1 REQUIREMENTS
- MECHANICAL CONTRACTOR TO MAINTAIN STRICT COMPLIANCE WITH ALL THE REQUIREMENTS OF THIS SPECIFICATION. ALL EQUIPMENT/SYSTEMS SHALL BE SUPPLIED, INSTALLED AND PROGRAMMED TO OPERATE AT OR ABOVE THE MINIMUM REQUIRED PERFORMANCE OUTLINED HEREIN.
- FAILURE TO COMPLY WITH THE REQUIREMENTS WILL RESULT IN THE REPLACEMENT, REINSTALLATION OR REPROGRAMMING OF EQUIPMENT/SYSTEMS TO ATTAIN TO THE SPECIFIED REQUIREMENTS AT THE CONTRACTORS EXPENSE.

O. FIRE STOP REQUIREMENTS
- FIRESTOP ALL PIPING, CONDUIT, ETC. WHERE IT PASSES THROUGH FIRE SEPARATIONS.
- REFER TO ARCHITECTURAL DRAWINGS FOR ALL LOCATIONS, MATERIAL AND METHODS OF FIRE STOPPING.

P. AS-BUILT DOCUMENTS
- AFTER AWARD OF CONTRACT THE CONTRACTOR IS TO REQUEST FROM THE CONSULTANT TO PROVIDE TWO (2) COMPLETE SETS OF CONTRACT DOCUMENTS FOR THE PURPOSE OF MAINTAINING AS-BUILTDRAWINGS.
- AS-BUILT DOCUMENTS SHALL INCLUDE:
  a. CONTRACT DRAWINGS
  b. ADDENDA AND BID REVISIONS
  c. CHANGE ORDERS AND OTHER MODIFICATIONS
  d. REVIEWED SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
  e. FIELD TEST RECORDS
  f. INSPECTION CERTIFICATES
  g. MANUFACTURER'S CERTIFICATES
- KEEP ONE COMPLETE SET OF AS-BUILT DOCUMENTS ON SITE. CLEARLY IDENTIFY RECORD DOCUMENTS AS "PROJECT RECORD COPY". MAINTAIN IN NEW CONDITION AND MAKE AVAILABLE FOR INSPECTION ON SITE BY OWNER AND CONSULTANT.
- KEEP AS-BUILT DOCUMENTS IN A SAFE LOCATION, CLEAN, DRY, AND IN A LEGIBLE CONDITION.
- DO NOT USE AS-BUILT DOCUMENTS FOR CONSTRUCTION PURPOSES, NOR CONSTRUCTION DRAWINGS FOR RECORD DOCUMENTS.
- IT IS IMPERATIVE FOR THE CONTRACTOR TO ACCURATELY AND NEATLY RECORD DEVIATIONS FROM CONTRACT DOCUMENTS CAUSED BY SITE CONDITIONS AND CHANGES ORDERED BY THE CONSULTANT.
- PROVIDE COLOURED MARKING PENS TO DIFFERENTIATE BETWEEN SYSTEMS, SECTIONS, AND DISCIPLINES.
- RECORD LOCATIONS OF CONCEALED COMPONENTS OF MECHANICAL AND ELECTRICAL SERVICES, INCLUDING CAPPED MECHANICAL AND UTILITY SERVICES FOR EXISTING BUILDING. DO NOT CONCEAL WORK UNTIL INFORMATION HAS BEEN ACCURATELY RECORDED.
- RECORD DEVIATIONS AND CHANGES ON A REGULAR AND ON-GOING BASIS, CONCURRENTLY WITH CONSTRUCTION PROCESS TO ENSURE ACCURACY.
- PRIOR TO SUBSTANTIAL COMPLETION OF WORK, TRANSFER NOTATIONS TO SECOND SET OF DRAWINGS. SUBMIT BOTH SETS OF DRAWINGS TO THE CONSULTANT AT SUBSTANTIAL COMPLETION OF WORK.

## 2. PLUMBING

A. PIPING MATERIALS
- DOMESTIC WATER PIPING: TYPE "L" HARD COPPER, WITH SOLDERED JOINTS OR VICTAULIC COPPER CONNECTIONS.
- COMBUSTIBLE PIPING EQUAL TO UPONOR PEX-A OR IPEX CPVC. VERIFY PIPING MEETS ALL REQUIRED FLAME SPREAD AND SMOKE DEVELOPED RATINGS, AND ALL APPLICABLE CSA, ASHRAE AND OBC REQUIREMENTS.
- WHEN USING SOLDER ON POTABLE WATER PIPING, USE 0.2% MAXIMUM LEAD SOLDER OR ALTERNATIVELY USE 90/5/5 (TIN/SILVER/ANTIMONY) LEAD FREE SOLDER.
- DRAIN, WASTE AND VENT LINES: PVC [SYSTEM 15] OR [XFR], CAST IRON WITH MECHANICAL JOINTS, COPPER DWV OR TRANSIT WITH CAST IRON FITTINGS IN ACCORDANCE WITH PROVINCIAL AND LOCAL. VERIFY PIPING MEETS ALL REQUIRED FLAME SPREAD AND SMOKE DEVELOPED RATINGS, AND ALL APPLICABLE CSA, ASHRAE AND OBC REQUIREMENTS.
- PLENUM REQUIREMENTS
  IF IT IS KNOWN OR EXPECTED THAT DROP CEILINGS ARE TO BE INSTALLED IN FUTURE TENANT FIT-UP, IPEX "SYSTEM 15" WILL NOT BE ACCEPTED. ALL COMBUSTIBLE PIPE AND FITTINGS LOCATED WITHIN A CONCEALED SPACE DESCRIBED IN THE O.B.C., 3.6.4.3.(1)(A) USED AS A RETURN PLENUM SHALL BE IPEX "SYSTEM XFR 15/50" OR EQUAL ALTERNATE AND SHALL BE TESTED AND LISTED TO CAN/ULC-S102.2-M AND HAVE A "FLAME-SPREAD RATING" NOT GREATER THAN "25" AND A "SMOKE DEVELOPED CLASSIFICATION" NOT GREATER THAN "50".
- GAS PIPING: SCHEDULE 40 STEEL WITH MALLEABLE IRON FITTINGS. USE YELLOW JACKET FOR UNDERGROUND PIPE AND PAINT SURFACE PIPE YELLOW TO CODE REQUIREMENTS. SUPPORT ROOF PIPEWORK ON CREOSOTE IMPREGNATED WOOD BLOCKS FLASHED INTO ROOF.

B. PIPING SUPPORTS
- SUPPORT ALL HORIZONTAL PIPING USING CLEVIS TYPE HANGERS AND ALL VERTICAL PIPING USING RISER CLAMPS. USE HANGERS OF SAME MATERIAL AS PIPE, OR INSULATING INSERTS BETWEEN HANGER AND PIPE. PROVIDE PIPE COVERING PROTECTION SADDLES AT EACH HANGER WHERE PIPES ARE INSULATED.

C. PLUMBING FIXTURES
- PROVIDE FIXTURES AS SHOWN ON DRAWING SCHEDULE OR AS APPROVED BY OWNER.
- FROST PROOF HYDRANT AND HOSE BIBB
  a. PROVIDE ANCON FROST PROOF WALL HYDRANT (FPWH) WITH SELF DRAINING INTEGRAL VACUUM BREAKER
  b. PROVIDE HOSE BIBB (H.B.) WITH INTEGRAL VACUUM BREAKER WHERE INDICATED UNLESS NOTED OTHERWISE ON DRAWINGS.
- CLEANOUTS
  a. CLEANOUTS SHALL BE MADE WITH ANCON MODEL CO-460 VERTICAL, STANDARD TY BRANCH OR Y BRANCH AND BEND USING ANCON MODEL CO-100-R CLEANOUTS. CLEANOUTS IN FINISHED WALLS SHALL BE CONCEALED WITH NICKEL BRONZE ACCESS COVERS WITH FRAMES. SIZE OF FRAME TO SUIT CLEANOUT AND BLOCK MODULE.
  b. CLEANOUTS SHALL BE PLACED WHERE SHOWN BUT WHETHER SHOWN OR NOT, THERE SHALL BE A CLEANOUT AT THE BASE OF EVERY SOIL STACK, RAIN WATER LEADER, AND WASTE STACK. INSTALL CLEANOUT ON MAIN BUILDING DRAIN JUST BEFORE IT LEAVES THE BUILDING.
- ESCUTCHEON PLATES
  a. PROVIDE ESCUTCHEON PLATES AT ALL WALLS WHERE PIPES ARE EXPOSED TO VIEW.
- UNIONS
  a. PROVIDE UNIONS TO CONNECT ALL PIPING TO EQUIPMENT TO FACILITATE EASE OF MAINTENANCE.
- ACCEPTANCE MANUFACTURERS (SPECIALTIES)
  a. ANCON, ZURN, WATTS OR J.R. SMITH

D. PROVIDE APPROVED ACCESS DOORS TO ALL VALVES, CONCEALED EQUIPMENT ETC.

E. VALVE AND PIPING IDENTIFICATION
- ALL VALVES ARE TO BE TAGGED TO IDENTIFY THE MEDIUM THROUGH VALVE AND VALVES PURPOSE.
- IDENTIFY ALL VISIBLE PIPING FULLY EXPOSED AND WHERE VISIBLE THROUGH ACCESSIBLE SPACES, SUCH AS LAY-IN TILE. IDENTIFY THE MEDIUM AND DIRECTION OF FLOW.
- PIPING TO BE IDENTIFIED ON BOTH SIDES WHERE PASSING THROUGH ANY PARTITION.
- LETTERING OF PIPING TO BE LEGIBLE AND BLOCK OR STENCIL TYPE.

F. PLUMBING VENTS
- PLUMBING VENTS ARE NOT NECESSARILY SHOWN ON DRAWINGS, IN ACCORDANCE WITH O.B.C. PART 7. ENSURE ALL VENTS THROUGH ROOF TERMINATE MINIMUM 3000MM FROM ANY FRESH AIR INTAKE.

K. PIPE INSULATION
- INSULATION OF DOMESTIC COLD/HOT WATER PIPING
  a. ALL VALVES AND FLANGES TO BE MOLDED OR FABRICATED SEGMENTS OF A THICKNESS EQUAL TO THAT OF THE PIPING INSULATION AND FINISHED WITH A LAYER OF ASBESTOS FREE CEMENT, TROWELLED SMOOTH AND COVERED WITH CANVAS.
  b. ALTERNATE METHOD FOR INSULATING FITTINGS: PREMOLDED HIGH IMPACT PVC FITTING COVERS WITH FIBERGLASS INSERTS, END JOINTS SEALED WITH PVC TAPE.
  c. EXPOSED INSULATION IE. UTILITY ROOMS, PARKING GARAGE, ETC.-- FINISH WITH VENTURECLAD MULTI-LAMINATE JACKET OR " LOSMOKE" PVC VAPOR BARRIER JACKET AND ADHERE WITH E.Z. WELD #1600 CEMENT ADHESIVE. SEAL ALL JOINTS WITH 4" (100MM) WIDE STRIP OF PVC TAPE.
- SANITARY PIPING
  a. FIBERGLAS HEAVY DENSITY FIBERGLASS INSULATION WITH FACTORY APPLIED ALL SERVICE VAPOR BARRIER JACKET LAPPED AND ADHERED WITH FLINTKPTE 203 ADHESIVE OR EQUAL. SEAL ALL JOINTS WITH 4"(100MM) WIDE STRIP OF ALL SERVICE JACKET MATERIAL.
- INSULATE ALL EXPOSED HOT AND COLD WATER SUPPLY PIPING, ALL DRAIN PIPING EXPOSED BELOW HANDICAP ACCESSIBLE LAVATORY BASINS WITH ½" THICK OWENS CORNING FIBERGLASS DOUBLE SURE PIPE INSULATION WITH ALL SERVICE JACKET. FINISH ALL EXPOSED INSULATION WITH 6 O.Z. FIRE RETARDANT CANVAS AND LAGGING.
- PIPING EXPOSED TO THE WEATHER
  a. INSULATION TO BE AS PER SECTION 2.K. OF THIS SPECIFICATION, WRAPPED WITH 55LB. ROOFING FELT WITH A 2"(50MM) OVERLAP AT LONGITUDINAL AND CIRCUMFERENTIAL JOINTS. ALL JOINTS SHALL BE POSITIONED TO SHED WATER, PIPING TO BE FINISHED WITH VENTURECLAD MULTI-LAMINATE JACKET OR WITH A 0.016 MIL EMBOSSED ALUMINUM JACKET WITH A 2"(50MM) OVERLAP AT LONGITUDINAL AND CIRCUMFERENTIAL JOINTS. SECURE IN PLACE WITH A ¾" x0.015" ALUMINUM BANDS ON 18"(450MM) CENTERS. CARE SHOULD BE TAKEN WITH ELECTRICALLY TRACED CABLE, WHICH WILL BE LOCATED INSIDE THE INSULATION.
- THICKNESS OF INSULATION

| APPLICATION | PIPE SIZE(NPS) AND INSULATION THICKNESS (INCHES) | | |
|---|---|---|---|
| | RUN-OUT | LESS THAN 1 ½ | 1 ½ OR OVER |
| DOMESTIC HOT WATER ( NON-COMBUSTIBLE) | 1 | 1 | 1 1/2 |
| DOMESTIC HOT WATER (COMBUSTIBLE) | 0 | 1 | 1 |
| DOMESTIC COLD WATER (NON-COMBUSTIBLE) | 1/2 | 1/2 | 1 |
| DOMESTIC COLD WATER (COMBUSTIBLE) | 0 | 1/2 | 1/2 |
| SANITARY PIPING (HORIZONTAL OR EXPOSED TO FREEZING CONDITIONS) | 1 | 1 | 1 |

NOTE:
1. RUN-OUTS TO INDIVIDUAL UNITS AND EQUIPMENT NOT EXCEEDING 4000MMLONG.
2. DO NOT INSULATE EXPOSED RUNOUTS TO PLUMBING FIXTURES, CHROME PLATED PIPING, VALVES, FITTINGS.
3. ALL EXPOSED COMBUSTIBLE PIPING TO BE INSULATED, REGARDLESS OF SERVICE, SIZE, OR LENGTH, BY A MINIMUM OF ½" THICK INSULATION AND JACKET IN ORDER TO PROTECT THE PIPING FORM UV DEGRADATION.

L. OIL INTERCEPTOR
- PROVIDE AS SHOWN ON DRAWING
- CONSTRUCTION DETAILS
  a. CONCRETE: 50 MPA HIGH DENSITY CONCRETE AT 28 DAYS, 5 TO 8% AIR ENTRAINMENT. (HIGHLY RESISTANT TO OIL ABSORBTION)
  b. REINFORCING: 4 X 4 6/6 WW MESH IN ROOF, WALLS, PARTITION AND FLOOR. EIGHT EXTRA 10 M BARS AROUND EACH ROOF ACCESS OPENING. MINIMUM COVER OVER REINFORCING STEEL - 25 MM.
  c. WEIGHT: 2965 KG (NOT INCLUDING RISERS)
  d. CAPACITY TO LIQUID LEVEL: 1050 LITRES
  e. MAXIMUM FLOW RATE: 25 LITRES PER MINUTE FOR THE SEPARATION OF UNEMULSIFIED OIL

M. WATER HEATER (DRAWING REFERENCE WH-1)
- PROVIDE AS SHOWN ON DRAWING
- DESIGN-CERTIFIED BY CSA INTERNATIONAL (FORMERLY AGA/CGA), TO MEET ANSI STANDARD Z-21.10.1 AND PEAK PERFORMANCE RATED.
- INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AUTHORITY HAVING JURISDICTION.

## 3. H.V.A.C.

A. DUCTWORK
- PROVIDE DUCTWORK AS INDICATED ON DRAWINGS.
- PROVIDE ALL DUCTWORK TO "SMACNA" STANDARDS. FABRICATE ALL DUCTWORK FROM GALVANIZED STEEL TO THE CLEAR INSIDE DIMENSIONS AS NOTED ON THE DRAWINGS, WITH ALL FLAT SURFACES CROSS BROKEN.
- INSTALL ALL DUCTS FREE FROM LEAKS AND SEAL ALL HOLES WITH 3M #474 TAPE.
- DUCT THICKNESS AS FOLLOWS UNLESS OTHERWISE NOTED ON THE DRAWINGS:

| MAXIMUM SIZE | GAUGE |
|---|---|
| UP TO 12" | 26 |
| 12" TO 30" | 24 |
| 31" & OVER | 22 |

- WHERE ANY CONSTRUCTION IMPEDIMENT OR REQUIREMENT RENDERS THE DIMENSIONS AS SHOWN ON THE DRAWINGS IMPOSSIBLE, ALTER DUCTWORK SO AS TO GIVE AN EFFECTIVE CROSS SECTION AREA EQUAL TO THE THAT ORIGINALLY SHOWN WITHOUT EXCEEDING AN ASPECT RATIO OF 4:1. MAKE CHANGES AT NO ADDITIONAL COST TO THE OWNERS.
- USE BENDS WHERE POSSIBLE. USE SQUARE ELBOWS C/W TURNING VANES WHEREVER BENDS ARE IMPRACTICAL.
- BRACE DUCTS SO THEY DO NOT VIBRATE OR SAG. SUPPORT HORIZONTAL DUCTS UP TO 508MM WIDE OR DEEP WITH 25MM X 14. GAUGE GALVANIZED STRAPS PASSING UNDER DUCTS, ON 2438MM CENTRES. USE ANGLE IRON SUPPORT FOR DUCTS OVER 508MM WIDE OR DEEP.
- PROVIDE APPROVED ACCESS DOORS TO ALL BALANCING AND FIRE DAMPERS ETC. UNLESS INDICATED OTHERWISE.
- PAINT INSIDE DUCTWORK BLACK WHERE VISIBLE THROUGH GRILLES, ETC.

B. DUCT INSULATION
- EXTERNAL INSULATION TO BE OWENS CORNING FIBREGLASS FLEXIBLE RFFRK INSULATION EQUAL TO R-4. INSULATE ALL EXHAUST DUCTWORK FOR A DISTANCE OF 6 FEET FROM EXTERIOR OUTLET, (EXCEPT IN ROOF SPACE; INSULATE ENTIRE LENGTH).
- INSULATE DUCTWORK EXPOSED TO WEATHER WITH OWENS CORNING FIBREGLASS RIGID RFFRK DUCT INSULATION EQUAL TO R-12, 20.4 KG ASPHALT IMPREGNATED ROOFING FELT WITH 3" OVERLAP AT JOINTS. SEAL WITH WATERPROOF MASTIC ADHESIVE AND HOLD IN PLACE WITH REINFORCED FIBREGLASS MESH COVERING BETWEEN COATS.
- EXTERNALLY INSULATE ALL FRESH AIR DUCTWORK WITH OWENS CORNING FIBREGLASS FLEXIBLE RFFRK INSULATION EQUAL TO R-5.0.
- INTERNAL DUCT INSULATION TO BE OWENS CORNING FIBREGLASS NEOPRENE COATED FIBREGLASS DUCT LINER, EQUAL TO R-4.
- MAKE PROVISIONS FOR DUCT LINER SO THAT SIZES SHOWN ON DRAWINGS ARE CLEAR INSIDE DIMENSIONS.

C. FIRE DAMPERS
- PROVIDE RUSKIN OR CONTROLLED AIR ULC RATED TYPE B FIRE DAMPERS WHERE SHOWN, AND DETAILED ON DRAWINGS. TYPE B DAMPERS IN ALL CASES UNLESS INDICATED OTHERWISE.
- INSTALL IN ACCORDANCE WITH N.F.P.A. 90 A FIRE DAMPER RATED TO SUIT FIRE RATING OF MEMBRANE TO BE PROTECTED. MECHANICAL CONTRACTOR TO REVIEW WITH GENERAL CONTRACTOR LOCATION OF ALL FIRE RATED MEMBRANES AND PROVIDE DAMPERS IN THESE MEMBRANES REGARDLESS IF INDICATED ON DRAWING OR NOT.
- CONTRACTOR TO PROVIDE ACCESS DOORS TO ALL FIRE DAMPERS OF ADEQUATE SIZE TO ENSURE EASY ACCESS FOR RESETTING DAMPERS. DOORS TO BE FIRE RATED WHERE LOCATED IN A FIRE RATED MEMBRANE.

D. DIFFUSER, GRILLES AND LOUVRES
- PROVIDE AS SCHEDULED ON THE DRAWINGS.
- STANDARD OF ACCEPTANCE: E.H.PRICE (AIROLITE), NAILOR, REVEROSOMATIC, BOFLEX, VENTEX.

E. FANS
- PROVIDE AS SCHEDULED ON THE DRAWINGS
- ADJUST FANS AND MOTORS TO OPERATE QUIETLY, AND MAKE DAMPERS TIGHT TO PREVENT VIBRATION.
- PROVIDE FANS WITH SPRING ISOLATION TO GIVE A MINIMUM 95% EFFICIENCY
- ALL FANS ARE PROVIDED BY THIS DIVISION.
- PROVIDE DUCTWORK AND TERMINALS FOR FANS PROVIDED BY THE ELECTRICAL CONTRACTOR.
- STANDARD OF ACCEPTANCE: BROAN, GREENHECK, NUTONE, REVERSOMATIC, PENNBARRY.

F. BALANCING
- PROVIDE SUFFICIENT BALANCING DAMPERS TO FACILITATE SYSTEM BALANCING.
- BALANCE TO PROVIDE AIR QUANTITIES SHOWN.
- CHANGE AND/OR ADJUST MOTORS AND MOTOR PULLEYS TO ACHIEVE AIR QUANTITIES AGAINST ACTUAL SYSTEM STATIC PRESSURE.

G. ROOF SUPPORTS
- PROVIDE ROOF CURBS AND/OR ROOF SLEEPER SUPPORTS WHERE SHOWN ON THE DRAWINGS AND/OR AS REQUIRED BY THE EQUIPMENT MANUFACTURER.
- HAND THEM OVER TO THE GENERAL CONTRACTOR FOR FLASHING INTO THE ROOF BY THE ROOFING CONTRACTOR.
- ALLOW FOR THE COST OF INSTALLATION.

H. GAS VENTS
- PROVIDE TYPE "B" GAS VENTS OF SIZE AS REQUIRED BY MANUFACTURER'S INSTRUCTIONS AND THE ONTARIO GAS UTILIZATION CODE AND LOCATION AS INDICATED ON DRAWINGS INCLUDING ALL NECESSARY SUPPORT PLATES, FIRE STOP SPACERS, WEATHER CAPS ETC.

I. CONTROLS
- CONTRACTOR TO PROVIDE ALL NECESSARY CONTROL WIRING AND CONTROL DEVICES AS REQUIRED TO ENSURE PROPER OPERATION OF EQUIPMENT AS SPECIFIED HEREIN.
- DEVICES ARE TO INCLUDE BUT NOT LIMITED TO THE FOLLOWING: 24 HOUR TIME CLOCK, THERMOSTATS, HUMIDISTATS, REVERSE ACTING THERMOSTATS, DAMPER ACTUATORS, SOLID STATE RELAYS, AIR PROVING SWITCHES, FLOW SWITCHES, TRANSFORMERS ETC.
- DOMESTIC HOT WATER HEATING SYSTEMS: PROVIDE ALL NECESSARY CONTROLS FOR THE DOMESTIC HOT WATER STORAGE TANK SYSTEM TO MAINTAIN 140 DEG. F IN THE TANKS.
- FURNACE/CONDENSING UNITS TO BE CONTROLLED BY 24 VOLT HEAT/COOL THERMOSTAT, HONEYWELL AUTO HEAT/COOL & AUTO FAN OR EQUAL. THERMOSTAT TO MAINTAIN DESIRED SET POINTS IN HEATING/COOLING MODE. THERMOSTAT TO HAVE A FAN ON/AUTO SWITCH TO ENABLE CYCLING OF THE FAN. THERMOSTAT TO BE MANUALLY SWITCHED FROM HEATING TO COOLING MODE. ALL CONTROL WIRING BETWEEN THERMOSTAT, FURNACE, AND CONDENSING UNIT SHALL BE BY MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR SHALL CO-ORDINATE AND ARRANGE WITH ELECTRICAL CONTRACTOR TO PROVIDE AND INSTALL ANY REQUIRED CONDUITS FOR CONTROL WIRING WITHIN SUITE.
- MOTORIZED DAMPERS: ALL MOTORIZED DAMPERS WILL BE CONTROLLED AS INDICATED IN THE FAN SCHEDULE. WHERE CONTROL IS NOT INDICATED, THE DAMPER TO BE IN CLOSED POSITION WHEN FAN IS "OFF" AND OPEN WHEN THE RESPECTIVE FAN IS ENERGIZED.

J. HEAT RECOVERY VENTILATOR (DRAWING REFERENCE ERV-1)
- PROVIDE AS SCHEDULED ON DRAWINGS.
- ACCEPTABLE MANUFACTURERS ARE VENMAR, LIFEBREATH & ALDES
- INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AUTHORITY HAVING JURISDICTION.
- COMPLY WITH ASHRAE 84
- DIMENSIONS: 33" X 27" X 21"
- TOTAL ASSEMBLED WEIGHT (INCLUDING POLYMERIZED PAPER CORE): 96 LB. . OVAL SHAPED PORTS; FIT 6" OR 7" ROUND DUCTS.
- UNIT TO BE CEILING MOUNTED COUNTER FLOW ENERGY RECOVERY VENTILATOR, CAPABLE OF OPERATING AT MINIMUM OF 75% SENSIBLE EFFICIENCY IN DESIGN OPERATION CONDITIONS.
- UNIT TO BE EQUIPPED WITH BUILT-IN TRUE AUTOMATIC ELECTRONIC AIR-BALANCING AND CONSTANT FLOW TECHNOLOGY
- UNIT TO BE EQUIPPED WITH A TILTED CORE DESIGN WHICH MAXIMIZES ANY DRAINAGE TO IMPROVE EFFICIENCY OF THE UNIT.
- UNIT TO BE EQUIPPED WITH 2 WASHABLE MERV 6 FILTERS,
- UNIT TO HAVE HIGH EFFICIENCY PERMANENTLY LUBRICATED ECM MOTORS (THERMALLY PROTECTED) FOR CONTINUOUS OPERATION.
- UNIT TO HAVE OPTION OF THREE (3) DEFROST MODES.
- UNIT TO BE HVI CERTIFIED, CSA APPROVED AND ENERGY STAR QUALIFIED.
- ENERGY RECOVERY CORE: DIMENSIONS: 14.25" X 14.25" X 16.6". EXCHANGE SURFACE: 136 FT$^2$. 26 LB. CROSS FLOW. MATERIAL: POLYMERIZED PAPER. WARRANTY: 5 YEARS
- CONTROLS: X-TOUCH WALL CONTROL OFFERING 5 MANUAL MODES (RECIRCULATION, 20 MIN/H, CONTINUOUS, SMART AND TURBO). UNIT TO BE INTERLOCKED WITH FURNACE, FAN COIL OR HEAT PUMP.
- WARRANTY: THE ECM IS PROTECTED BY A 5- YEAR WARRANTY ON PARTS ONLY, EXCEPT FOR THE ENERGY RECOVERY CORE, WHICH IS COVERED BY A 10-YEAR WARRANTY, WITH THE ORIGINAL PROOF OF PURCHASE.

K. INFRARED HEATING (DRAWING REFERENCE IR-1)
- PROVIDE AS SCHEDULED ON DRAWINGS.
- ACCEPTABLE MANUFACTURERS ARE ROBERTS GORDON AND SUPERIOR RADIANT PRODUCTS.
- LOW INTENSITY ADAPTIVE MODULATING INFRARED TUBE HEATERS. HEAVY DUTY INDUSTRIAL/COMMERCIAL INFRARED HEATER FEATURING THE BEST OVERALL PERFORMANCE IN THE INDUSTRY AUTOMATICALLY ADJUSTS AIR AND GAS TO PROPERLY REGULATE THE TEMPERATURE IN A GIVEN SPACE THROUGH A PATENT APPLIED FOR TECHNOLOGY TO MAINTAIN UP TO 40% MODULATING DIFFERENTIAL BY DIRECT ANALOG SIGNAL. THE CONTROLS ARE TO BE SIMPLE, EFFECTIVE AND NONPROPRIETARY. THE AM UNIT MUST READ THE ROOM AND ADJUST ITSELF ACCORDINGLY. PRE-PROGRAMED UNITS WILL NOT BE ACCEPTED. STEADY STATE THERMAL EFFICIENCY WILL BE IN EXCESS OF 80%. 100% EFFICIENT REFLECTOR DESIGN. BAFFLES REQUIRED AS PER MANUFACTURER'S INSTRUCTIONS.
- ASSEMBLIES SHALL BE CSA APPROVED LOW INTENSITY HEATER TO LATEST ANSI Z83.20 AND CSA 2.34 FOR USE IN COMMERCIAL AND INDUSTRIAL APPLICATIONS. BURNER SHALL BE A POSITIVE PRESSURE BURNER SYSTEM WHERE EXHAUST GASES AND OTHER PRODUCTS OF COMBUSTION ARE NOT ROUTED THROUGH THE BLOWER. THE BURNER SHALL OPERATE AT A MINIMUM GAS INLET PRESSURE OF 5.3 INCHES W.C. (NATURAL GAS) AND DRAW NO MORE THAN 1.2 AMP AT 120VAC, 60HZ.
- BURNER HEAD SHALL BE CHROME PLATED STEEL AND BURNER CONTROLS SHALL BE LOCATED OUTSIDE OF THE AIR SUPPLY STREAM TO ALLOW SERVICE AND DIAGNOSTIC CONTROL CHECKS WITH THE BURNER OPERATING. REFLECTOR SHALL HAVE A MINIMUM 10-SIDED DESIGN REFLECTING VIRTUALLY 100% OF THE INFRARED ENERGY OUT AND AWAY FROM THE EMITTER REFLECTOR SHALL BE "DEEP DISH" DESIGN WITH EMITTER TUBES FULLY RECESSED WITHIN REFLECTOR. REFLECTORS WITH FEWER THAN 10 SURFACES WILL NOT BE ALLOWED AS THEY ALLOW ENERGY TO BOUNCE BACK TO THE MAIN HEAT EXCHANGER TUBING. REFLECTOR SHALL BE MILL-FINISHED ALUMINUM, ASTM 1100, .024 INCH THICKNESS ALUMINUM SHEET METAL WITH TWO REFLECTOR SUPPORT BRACKETS FOR EACH 10 FEET (3048 MM) REFLECTOR SECTION. REFLECTORS SHALL EXTEND BELOW THE LOWEST POSITION OF THE TUBING AT ALL TIMES. REFLECTOR END CAPS SHALL BE FITTED TO THE END OF EACH REFLECTOR RUN TO REDUCE CONVECTIVE HEAT LOSS, AND SHALL BE STANDARD EQUIPMENT. EMITTER TUBE SHALL BE 4 INCH (102 MM) DIAMETER, MINIMUM 16 GAUGE THICKNESS. COMBUSTION TUBE SHALL BE 4 INCHES (102 MM) DIAMETER, 16 GAUGE, HEAT TREATED TYPE 1 ALUMINIZED STEEL TUBING AND SHALL BE REQUIRED FOR ALL FIRING RATES. HOT ROLLED STEEL COMBUSTION TUBING SHALL NOT BE ALLOWED. COMBUSTION TUBING SHALL INCORPORATE A WELDED, 11 GAUGE STEEL, 4 BOLT FLANGE TO ORIENT THE BURNER TO THE TUBE AS DESIGNED. COUPLINGS SHALL BE 16 GAUGE ALUMINIZED STEEL, MINIMUM 12 INCHES IN LENGTH AND BE OF HEAVY DUTY DESIGN INCORPORATING TWO 1- INCH WIDE DRAW BANDS.
- VENTING: REFER TO CAN/CGA B149.1 AND B149.2 INSTALLATION CODES IN CANADA FOR PROPER LOCATION, SIZING AND INSTALLATION OF VENTS AS WELL AS INFORMATION ON CLEARANCE REQUIREMENTS WHEN PENETRATING COMBUSTIBLE WALLS FOR VENTING PURPOSES.

L. FUEL-FIRED FURNACE (DRAWING REFERENCE F-1)
- PROVIDE AS SCHEDULED ON DRAWINGS.
- BLOWER WHEEL AND BLOWER MOTOR: GALVANIZED BLOWER WHEEL SHALL BE CENTRIFUGAL TYPE, STATICALLY AND DYNAMICALLY BALANCED. BLOWER MOTOR OF PSC TYPE SHALL BE PERMANENTLY LUBRICATED WITH SLEEVE BEARINGS, AND SHALL HAVE MULTIPLE-SPEEDS FROM 500-1150RPM OPERATING ONLY WHEN 115-VAC MOTOR INPUTS ARE PROVIDED. BLOWER MOTOR SHALL BE DIRECT DRIVE AND SOFT MOUNTED TO THE BLOWER HOUSING TO REDUCE VIBRATION TRANSMISSION.
- FILTERS: FURNACE SHALL HAVE 1 INCH REUSABLE-TYPE FILTERS.(FILTER SHALL BE HIGHLY EFFICIENT MERV8 MEDIA FILTER).
- CASING: CASING SHALL BE OF 0.030INCH THICKNESS MINIMUM, PRE-PAINED STEEL.
- INDUCER MOTOR: INDUCER MOTOR SHALL BE SINGLE-SPEED PSC DESIGN.
- PRIMARY HEAT EXCHANGERS: PRIMARY HEAT EXCHANGERS SHALL BE 3-PASS CORROSION RESISTANT ALUMINIZED STEEL OF FOLD-AND -CRIMP SECTIONAL DESIGN AND APPLIED OPERATING UNDER NEGATIVE PRESSURE.
- SECONDARY HEAT EXCHANGERS: SECONDARY HEAT EXCHANGERS SHALL BE OF A STAINLESS STEEL FLOW-THROUGH OF FIN-AND-TUBE DESIGN AND APPLIED OPERATING UNDER NEGATIVE PRESSURE.
- CONTROLS: CONTROLS SHALL INCLUDE A MICRO-PROCESSOR-BASED INTEGRATED ELECTRONIC CONTROL BOARD WITH AT LEAST 16 SERVICE TROUBLESHOOTING CODES DISPLAYED VIA DIAGNOSTIC FLASHING LED LIGHT ON THE CONTROL, A SELF-TEST FEATURE THAT CHECKS ALL MAJOR FUNCTIONS OF THE FURNACE, AND A REPLACEABLE AUTOMOTIVE-TYPE CIRCUIT PROTECTION FUSE. MULTIPLE OPERATIONAL SETTINGS AVAILABLE INCLUDING BLOWER SPEEDS FOR HEATING AND COOLING. CONTINUOUS FAN SPEED IS THE SAME AS THE SELECTED HEATING SPEED.
- STANDARD OF ACCEPTANCE: CARRIER, TRANE, YORK.

L. CONDENSING UNIT (DRAWING REFERENCE CU-1)
- PROVIDE AS SCHEDULED ON DRAWINGS.
- THE OUTDOOR UNIT SHALL BE COMPLETELY WEATHERPROOF AND CORROSION RESISTANT. THE UNIT SHALL BE CONSTRUCTED FROM RUST-PROOFED MILD STEEL PANELS COATED WITH A BAKED ENAMEL FINISH.
- THE FAN SHALL BE A DIRECT DRIVE, PROPELLER TYPE FAN. THE MOTOR SHALL BE INVERTER DRIVEN WITH PERMANENTLY LUBRICATED BEARINGS
- A FAN GUARD SHALL BE PROVIDED ON THE OUTDOOR UNIT TO PREVENT CONTACT WITH FAN OPERATION.
- THE OUTDOOR COIL SHALL HAVE NONFERROUS CONSTRUCTION WITH A CORRUGATED FIN TUBE.
- COMPRESSOR SAFETIES SHALL INCLUDE INTERNAL THERMAL OVERLOAD PROTECTION. REFRIGERATION SPECIALTIES SHALL INCLUDE AN ACCUMULATOR, REFRIGERANT METERING DEVICE AND A FOUR-WAY REVERSING VALVE.
- ELECTRICAL: THE OUTDOOR UNIT SHALL BE POWERED WITH 208-230 VOLTS, 1 PHASE, 60 HERTZ POWER.

M. CO & $NO_2$ SENSOR
- PROVIDE AS INDICATED ON DRAWINGS.
- ACCEPTABLE MANUFACTURERS ARE ARJAY ENGINEERING, HONEYWELL, OR ENGINEERS APPROVED EQUIVALENT.
- PROVIDE ALL LABOUR, MATERIALS, PRODUCT, EQUIPMENT AND SERVICE TO INSTALL A COMPLETE GAS DETECTION AND CONTROL SYSTEM AS INDICATED ON THE DRAWINGS AND SPECIFIED IN THIS SECTION.
- PROVIDE AND INSTALL A COMPLETE GAS DETECTION AND CONTROL SYSTEM WHERE THE VENTILATION SYSTEM WILL BE HOOKED UP DIRECTLY TO THE GAS DETECTION SYSTEM. THE SYSTEM STANDARD SHALL BE AS THE EC-GOLD DUAL AS MANUFACTURED BY ARJAY ENGINEERING, OR ENGINEERS APPROVED EQUIVALENT.
- PROVIDE ALL WORK AS INDICATED ON PLANS AND DIAGRAMS.
- REFERENCE STANDARDS: ALL PRODUCTS SHALL BE CERTIFIED TO CSA STANDARDS. MANUFACTURER SHALL BE AUDITED AND CERTIFIED TO ISO 9001:2008.
- THE CONTROLLER AND SENSOR PACKAGE SHALL BE ARJAY EC-GOLD DUAL OR ENGINEER APPROVED EQUAL. IT SHALL BE A SELF-CONTAINED UNIT WITH ONBOARD CONTROL RELAYS AND SENSOR CAPABILITY.
- THE UNIT MUST INCLUDE A SELF-DIAGNOSTIC FUNCTION.
- THE UNIT SHALL HAVE BOTH CO AND $NO_2$ ONBOARD AND REMOTE INPUT CAPABILITY OF A FUTURE PROPANE SENSOR AND AN ADDITIONAL REMOTE ANALOG INPUT SENSOR.
- THE UNIT SHALL PROVIDE THREE RELAYS FOR COMMON SENSOR ALARM OF LOW, HIGH AND FAULT. THE FAULT RELAY CAN BE RE-ASSIGNED AS A HIGH/HIGH RELAY IF REQUIRED.
- A 4-20 MA OUTPUT INDICATIVE OF THE HIGHEST, NOT AVERAGED, CONCENTRATION OF ALL THE SENSOR INPUTS SHALL BE PROVIDED.
- A MODBUS RS-485 COMMUNICATION SHALL BE INCLUDED.
- AN LCD DISPLAY OF THE CONCENTRATION OF THE SENSOR INPUTS SHALL BE PROVIDED WITH COMMON LED ALARM STATUS INDICATION AND ALARM BUZZER WITH SILENCE BUTTON.
- THE UNIT IS TO BE PROVIDED IN A METAL HOUSING WITH SHIELDED SENSORS AND FIELD SELECTABLE SURFACE OR REAR MOUNT CONDUIT ENTRY KNOCK-OUTS
- THE ON-BOARD CO AND $NO_2$ SENSORS SHALL BE ELECTROCHEMICAL TYPE.
- THE POWER INPUT SHALL BE 24 VDC. A SEPARATE 115 VAC/24 VDC POWER SUPPLY SHALL BE PROVIDED AS REQUIRED.
- THE CONTROL PANEL WILL LEAVE THE FACTORY FULLY PROGRAMMED AND CALIBRATED AND WILL BE ADJUSTABLE IN THE FIELD VIA THE KEYPAD. PROGRAMMING MUST BE SAVED IN THE EVENT OF POWER LOSS.
- THE UNIT TO BE DESIGNED FOR OPERATION BETWEEN -20 C AND 40 C.
- UNIT WILL BE CERTIFIED TO CSA STANDARDS. THE CONTROLLER MUST BE MANUFACTURED WITHIN AN ISO 9001-2008 AUDITED AND CERTIFIED PRODUCTION ENVIRONMENT.
- ALL CONTROLLER HARDWARE TO BE PROVIDED WITH A TWO YEAR PARTS GUARANTEE. THE PLUG-IN CO AND $NO_2$ SENSORS WILL HAVE A 3 YEAR GUARANTEE.
- THE INSTALLING CONTRACTOR SHALL MEET ALL REQUIREMENTS AS PER THE DRAWINGS AND SPECIFICATIONS AND AS PER THE MANUFACTURERS INSTALLATION GUIDELINES.
- THE INSTALLING CONTRACTOR SHALL REVIEW WITH SUPPLIER THE REQUIRED NUMBER OF CONTROL RELAY CONTACTS TO EFFECTIVELY INTERFACE THE GAS MONITORING PANEL WITH FANS, FIRE ALARM PANELS, HOAS AND/OR REMOTE DEVICES THAT MAY NOT BE INDICATED WITHIN THIS SCOPE.
- PROVIDE COMPLETE START UP AND COMMISSIONING SERVICE BY THE MANUFACTURERS AUTHORIZED REPRESENTATIVE.
- PROVIDE A CERTIFICATE OF CALIBRATION FROM THE MANUFACTURER INDICATING SENSORS ARE CALIBRATED AS PER SPECIFICATIONS AND CODE REQUIREMENTS.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE. DO NOT SCALE DRAWINGS. DRAWINGS AND SPECIFICATIONS REMAIN THE PROPERTY OF THE ENGINEER AS INSTRUMENTS OF HIS SERVICE AND MUST BE RETURNED AT HIS REQUEST.

| No. | REVISION | DATE |
|---|---|---|
| 1 | ISSUED FOR TENDER | SEPT 6'17 |
| 0 | ISSUED FOR OWNER REVIEW | AUG 25'17 |

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SPECIFICATIONS
-MECHANICAL

| | |
|---|---|
| DRAWN: VL | SCALE: N.T.S. |
| DESIGN: VL | CHECKED: VL |
| DRAWING No. M2.5 | REVISION: R1 |