Lakeside Towers

220-55 46th Avenue

Flushing, NY 11361

As-Built August 2020

Submitted to:

Frontier Energy
2695 Bingley Road
Cazanovia, NY 13035

Submitted by:

Tecogen, Inc.
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www.Tecogen.com

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1. Introduction

Tecogen, Inc. (Tecogen) designed and oversaw the installation of a combined heat and power (CHP) system at Lakeside Towers. The site is receiving an incentive from NYSERDA, of which the first two milestones have been paid out in full. The CHP system includes one (1) INV-e+ 125kW engine generator unit. The inverter-based system is intended to produce a gross output of 125 kW and recover engine jacket water and exhaust heat recovery for:

   a) Pre-heating the DHW condensate loop which in turn heats:
      i. DHW heating,

The CHP system will not be addressing the space heating as this is done via steam generation. The CHP system will provide power in parallel with the existing utility service, as well as the capabilities to operate in island-mode and provide backup power during an outage scenario.

2. Instrumentation

In order to quantify the performance of the CHP system, the CHP system fuel input, net electrical output, and useful thermal output will be measured. To capture that data Tecogen supplied the meters and instrumentation listed in **Table 1 on page 4.**

<u>Data Logger</u>

Readings for the installed instrumentation are recorded by a CHPInsight datalogger provided and installed by Tecogen. The computer samples all sensors approximately once per 30 seconds and records the information. The readings of heat recovery temperatures and flow rates will be used to provide an accurate calculation of heat transfer on the heat recovery loops, which are all continuous flow loops. Based on the number of monitored data points, the logger will have sufficient memory to store 3-days of data if communications with the logger are interrupted.

The data will be downloaded from CHPInsight once per day via an Internet connection provided by the Site. The data will be loaded into a Tecogen database for long term storage and checked for validity.

<u>Onsite Installation</u>

Tecogen installed a CHPInsight panel in the cogen room right next to the TCP and CHP Panel. The monitoring system panel is approximately 2 ft x 16 in x 10 in. The panel is supplied with 120 VAC power (it requires 1 amp or less). The panel is conveniently located relative to the sensors listed above as well as the communications line provided by the site.

<u>Communications</u>

The CHPInsight has a connection to the Internet. An IP address has been supplied. The logger uploads data every night to the Tecogen servers, is compiled into a csv file, and then distributed on an annual basis and provided to NYSERDA based on their monitoring requirements.

On Site Support

The facility has assisted in providing a network connection for the CHPInsight. Tecogen is responsible for providing a complete monitoring installation, as well as any access for return trips to verify sensors or service the monitoring system.

Table 1. Overview of CHP System Monitoring Instrumentation

Data Point	Tecogen Label	Description	Units	Instrument / Sensor	Output Type	Location
P_{NET}	EM-1	Generator NET Electrical Output	kW/ kWh	Veris E50C2	ModBus	Electric Room
P_{OUT}	INV	Generator Gross Electrical Output	kW/ kWh	InVerde	On-Board	CHP Room
G_{IN}	GM-1	Net Generator Fuel Input	CF	Demark Pulse Output (ConEd)	Pulse	Gas Meter Room
T_{OUT1}	BTU-S1	Engine Heating Module Supply Temperature	°F	RTD Sensor	ModBus	CHP Room
T_{RET1}	BTU-R1	Engine Heating Module Return Temperature	°F	RTD Sensor	ModBus	CHP Room
F_{NET1}	BTU-1	Engine Heating Module System Flow	GPM	Badger Meter M5000 Series	ModBus	CHP Room
Q_{NET1}	BTU-1	CHP Engine Heat Supplied	BTUh	Calculated	ModBus	CHP Room

3. Data Analysis

The collected data listed in Table 1 on page 4 will be used to determine the net power output of the system as well as the fuel conversion efficiency (FCE).

Peak Demand or Peak kW

The peak electric output or demand for each power reading will be taken as the average kW in a fixed 15-minute interval (0:00, 0:15, 0:30, etc.), defined as:

$$kW = \frac{\sum_{15\,min} kWh}{\Delta T} = \frac{kWh\ per\ interval}{0.25h}$$

Net Power Output

The power meter will measure the generator power output (P_{OUT}). The internal generator meter will measure the gross output of the engine generator as a check.

The parasitic power (P_{PAR}) is estimated to be 1.5 kW. The net power (P_{NET}) can be determined by subtracting parasitic power (P_{PAR}) from the power output (P_{OUT}).

$$kW_{NET} = P_{OUT} - P_{PAR}$$

Heat Recovery Rates

The heat recovery rates will be calculated based on the 30 second interval data collected. The piping arrangement at this site allows for the total recoverable heat rate to be determined at one location as there is no heat rejection unit included with the installation:

The rate of useful heat recovery in Btu/h is defined as:

$$Q_{NET} = C_P \times \sum (F_{NET} \times (T_{OUT} - T_{RET})\ \times n)$$

where: C_p = ~ 500 Btu/h-gpm-°F for pure water;
n = Number of 1-minute intervals included in period of interest

The heat recovery loop fluid is expected to be pure water.

Any heat recovery measurement can be calculated for an interval sum (Btu) by the following:

Calculated Quantities

The fuel conversion efficiency (FCE) of the CHP system, based on the higher heating value of the fuel, will be defined as:

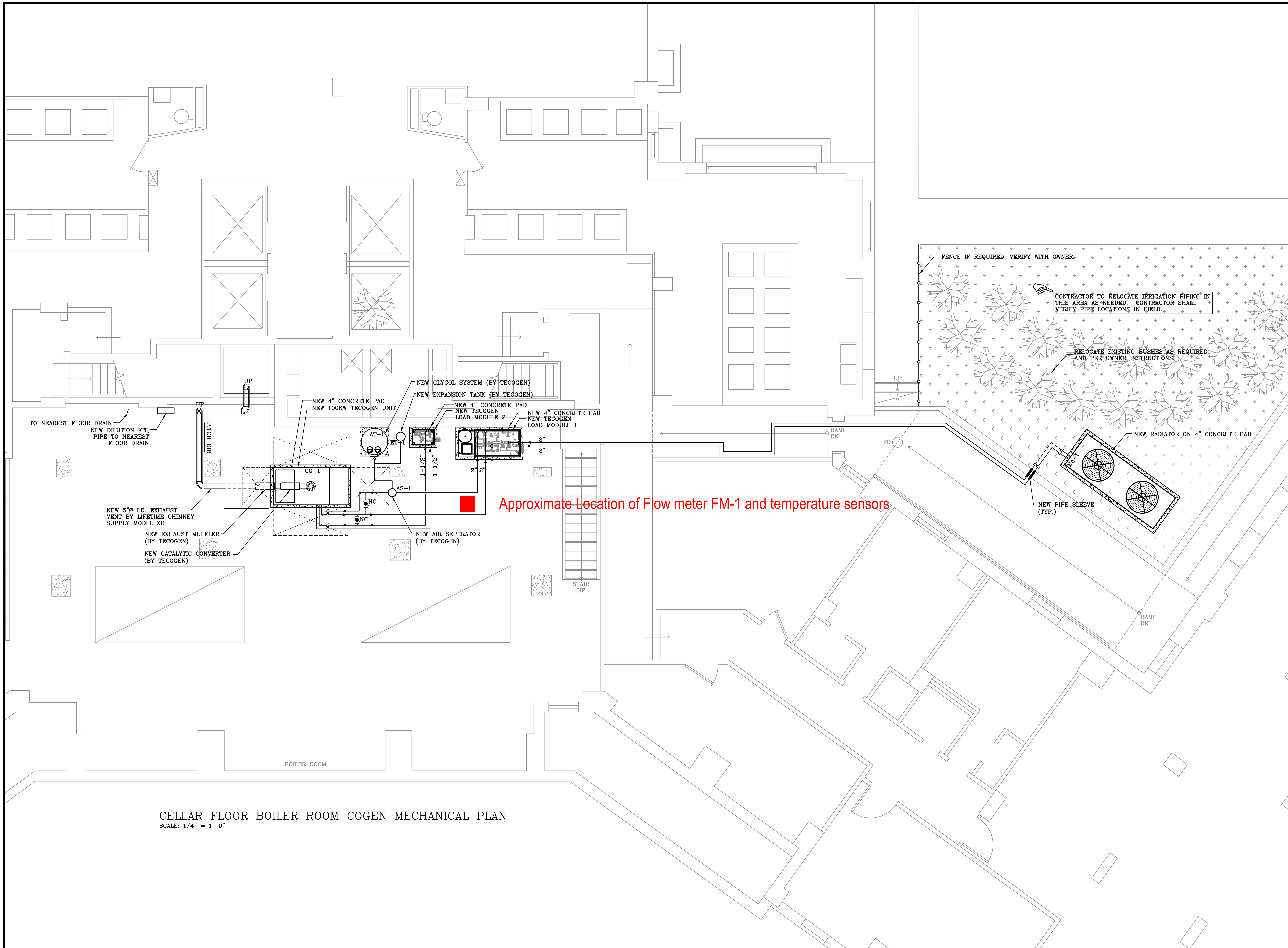
$$FCE = \frac{Q_{NET}\ +\ (3413\ \times\ P_{NET})}{G_{IN}\ \times\ HHV_{Gas}}$$

where: Q_{Net} = Total Useful heat recovery (Btu) (QU)
P_{Net} = Engine generator net output (kWh)
G_{In} = Generator gas consumption (Std CF)
HHV_{gas} = Higher heating value for natural gas (~1020 Btu/CF)

The FCE can be calculated for any time interval of interest (hourly, daily, monthly, etc.), depending on the resolution available for the gas meter reading.

Appendix A

System Schematics



CELLAR FLOOR BOILER ROOM COGEN MECHANICAL PLAN

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

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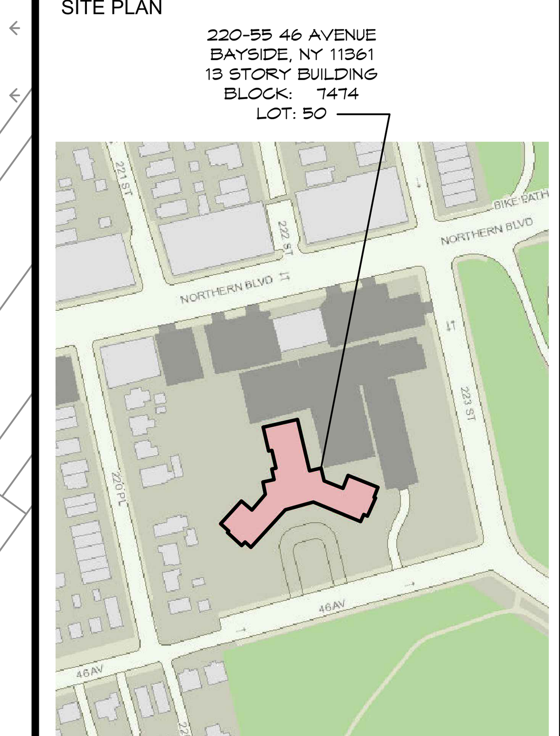
SITE PLAN



NO.	DATE	ISSUE/REV.
1	08/31/2017	50% CD - FOR CLIENT REVIEW

CLIENT

LAKESIDE TOWERS CORP.
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT

LAKESIDE TOWERS CHP

DRAWINGS TITLE

CELLAR FLOOR BOILER ROOM COGEN MECHANICAL PLAN

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DATE

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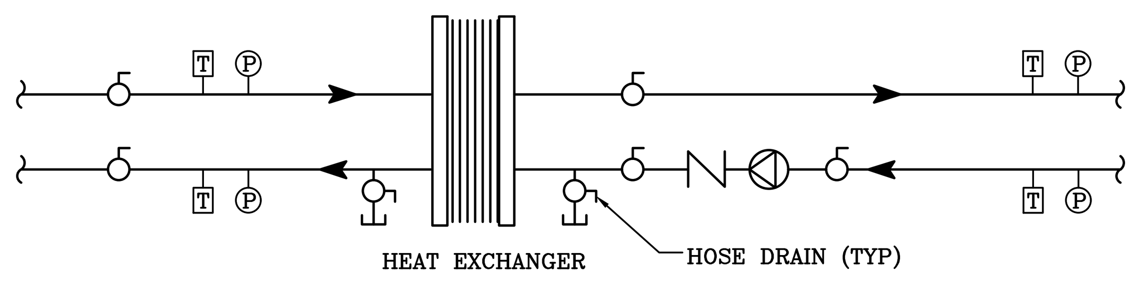
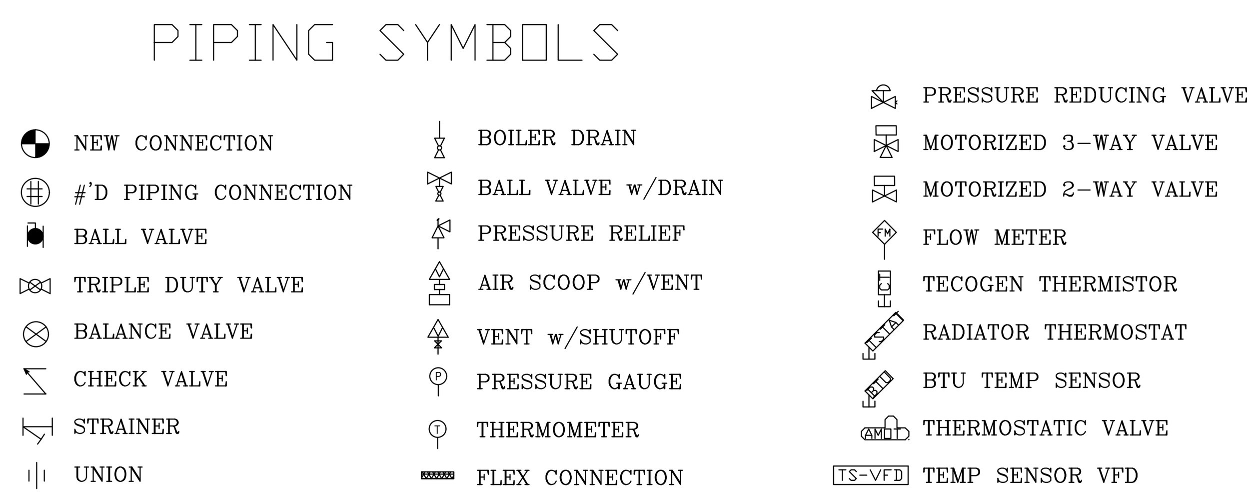
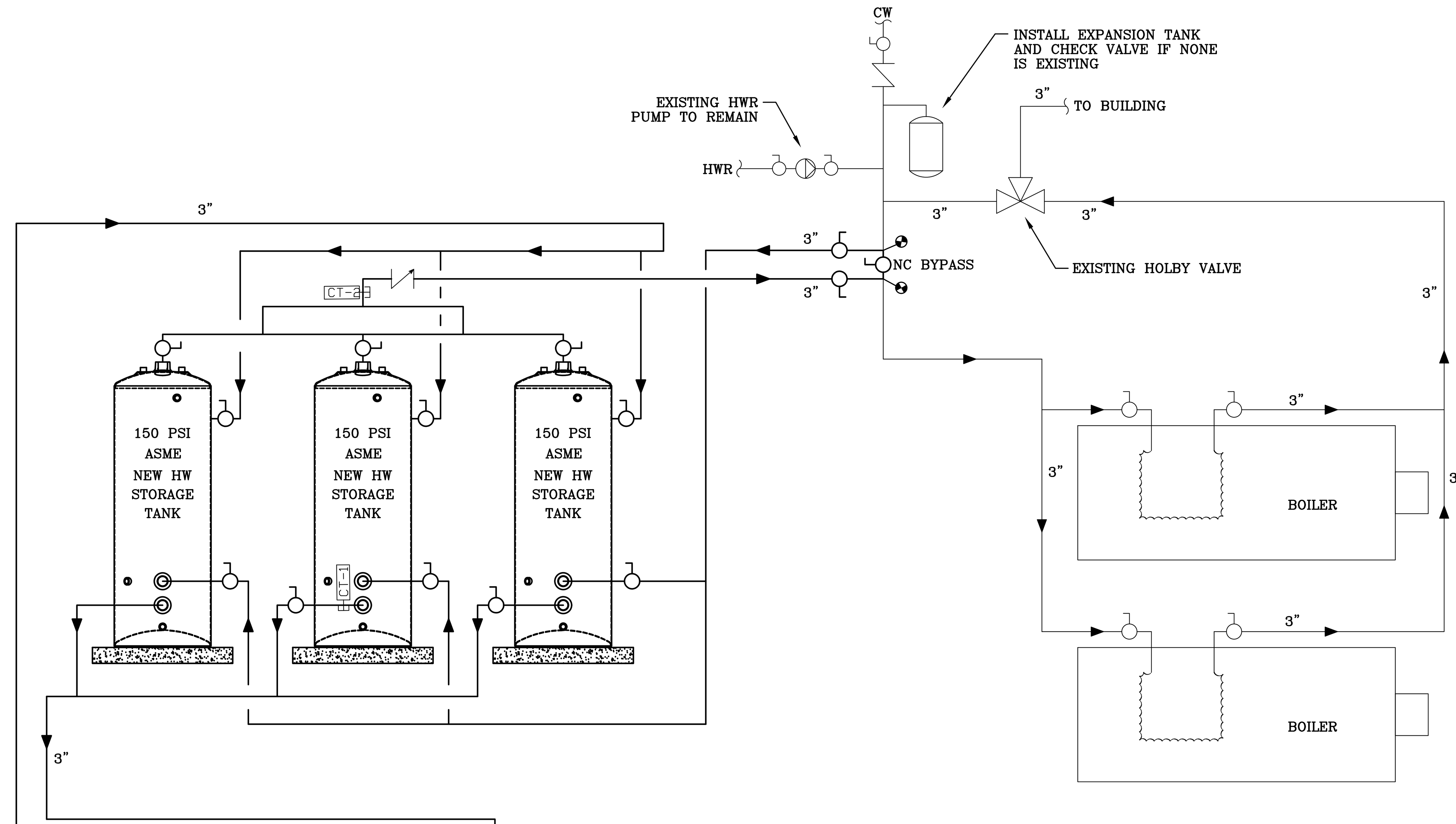
M-101.00

SHEET 3 OF 14

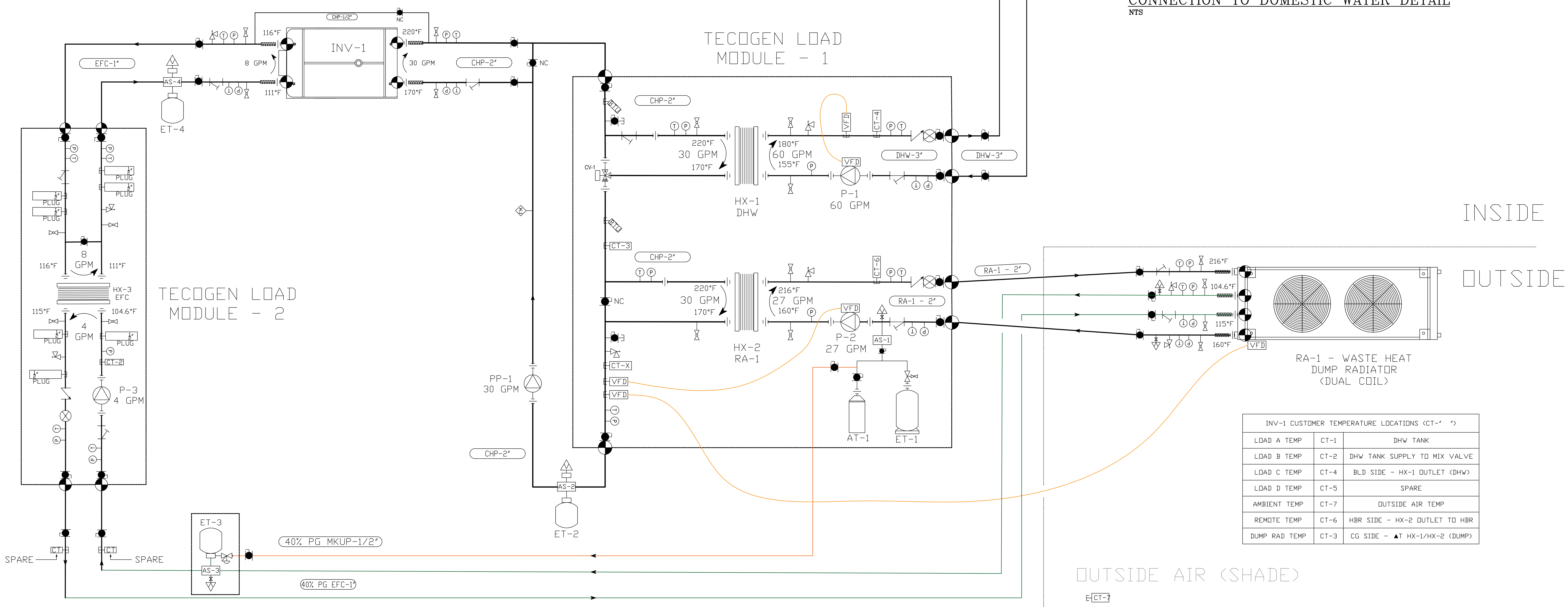


TYPICAL HX CONNECTION
NTS





CONNECTION TO DOMESTIC WATER DETAIL
NTS



INV-1 CUSTOMER TEMPERATURE LOCATIONS (CT-* *)		
LOAD A TEMP	CT-1	DHW TANK
LOAD B TEMP	CT-2	DHW TANK SUPPLY TO MIX VALVE
LOAD C TEMP	CT-4	BLD SIDE - HX-1 OUTLET (DHW)
LOAD D TEMP	CT-5	SPARE
AMBIENT TEMP	CT-7	OUTSIDE AIR TEMP
REMOTE TEMP	CT-6	HBR SIDE - HX-2 OUTLET TO HBR
DUMP RAD TEMP	CT-3	CG SIDE - ΔT HX-1/HX-2 (DUMP)

TYPICAL COGEN PIPING SCHEMATIC
NTS

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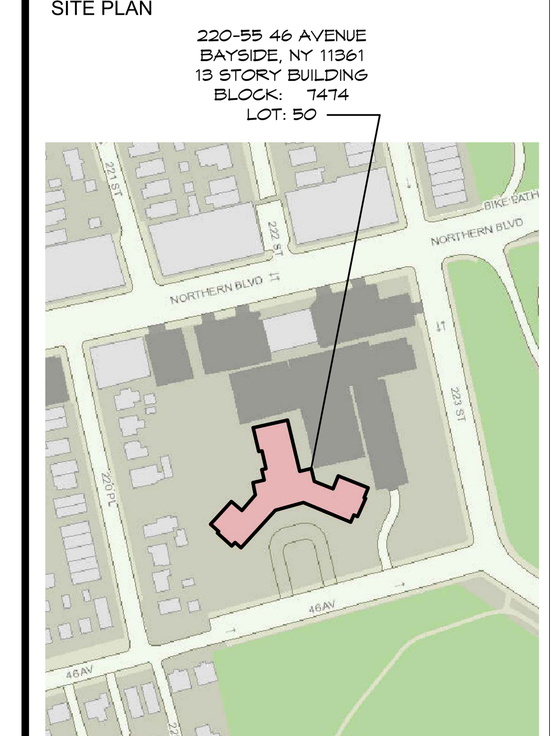

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1	08/31/2017	50% CD - FOR CLIENT REVIEW
2	10/24/2017	BID SET
3	12/12/2017	BID SET
4	12/28/2017	BID SET

CLIENT
LAKESIDE TOWERS
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP AND RELATED WORK

DRAWINGS TITLE
CHP PIPING SCHEMATIC AND DETAILS

DRAWN BY	CHECKED BY	PROJECT NO.
GB	NR	2017-600

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12/28/17

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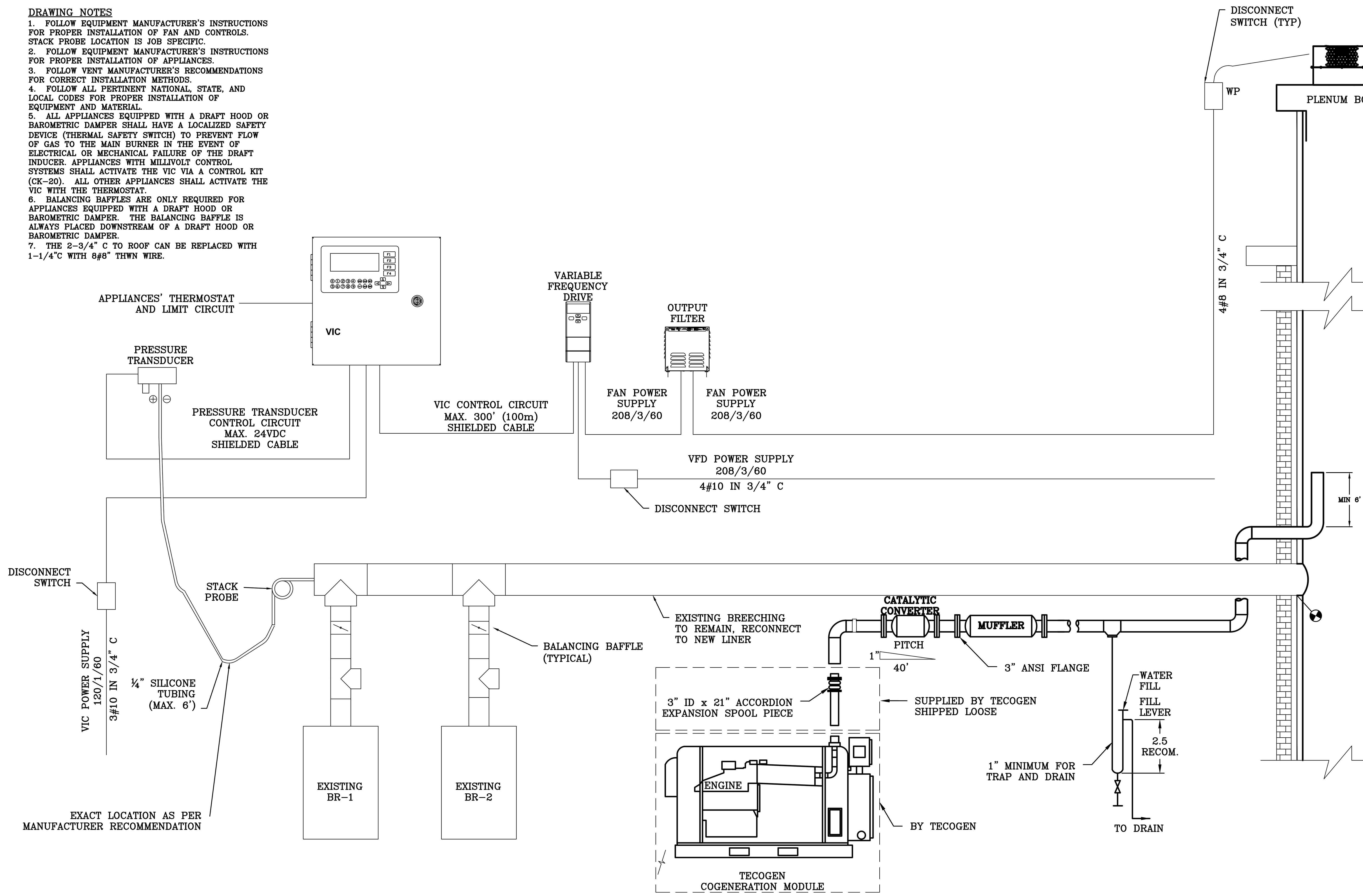
P-202.00

DRAWING NOTES
1. FOLLOW EQUIPMENT MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION OF FAN AND CONTROLS. STACK PROBE LOCATION IS JOB SPECIFIC.
2. FOLLOW EQUIPMENT MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION OF APPLIANCES.
3. FOLLOW VENT MANUFACTURER'S RECOMMENDATIONS FOR CORRECT INSTALLATION METHODS.
4. FOLLOW ALL PERTINENT NATIONAL, STATE, AND LOCAL CODES FOR PROPER INSTALLATION OF EQUIPMENT AND MATERIAL.
5. ALL APPLIANCES EQUIPPED WITH A DRAFT HOOD OR BAROMETRIC DAMPER SHALL HAVE A LOCALIZED SAFETY DEVICE (THERMAL SAFETY SWITCH) TO PREVENT FLOW OF GAS TO THE MAIN BURNER IN THE EVENT OF ELECTRICAL OR MECHANICAL FAILURE OF THE DRAFT INDUCER. APPLIANCES WITH MILLIVOLT CONTROL SYSTEMS SHALL ACTIVATE THE VIC VIA A CONTROL KIT (CK–20). ALL OTHER APPLIANCES SHALL ACTIVATE THE VIC WITH THE THERMOSTAT.
6. BALANCING BAFFLES ARE ONLY REQUIRED FOR APPLIANCES EQUIPPED WITH A DRAFT HOOD OR BAROMETRIC DAMPER. THE BALANCING BAFFLE IS ALWAYS PLACED DOWNSTREAM OF A DRAFT HOOD OR BAROMETRIC DAMPER.
7. THE 2–3/4" C TO ROOF CAN BE REPLACED WITH 1–1/4"C WITH 8#8" THWN WIRE.



CB–FH CHIMNEY FAN SCHEMATIC INSTALLATION DETAIL
(ADD ALTERNATE – SEE FORM OF PROPOSAL)

NTS

UL–LISTED FLUE LINER NOTES:

A. THE FACTORY BUILT LINER SYSTEM SHALL BE MADE IN ACCORDANCE WITH NFPA 211. THIS STACK SYSTEM SHALL BE DESIGNED AND INSTALLED TO BE GAS TIGHT. IT SHALL BE UL 103 LISTED TO WITHSTAND UP TO 60" W.C. POSITIVE PRESSURES. THE SYSTEM SHALL BE DESIGNED TO COMPENSATE FOR ALL FLUE GAS INDUCED THERMAL EXPANSIONS. CLEARANCES TO COMBUSTIBLE MATERIALS SHALL BE PER INSTALLATION INSTRUCTIONS.

B. THE JOINT ASSEMBLY SHALL BE A MALE/FEMALE SLIP–TYPE JOINTING WITH FLANGE TO FLANGE AND V–BAND ASSEMBLY. AN INTERNAL SLEEVE SERVES FOR READILY ALIGNMENT AS WELL AS LONG TERM JOINT SEAL PROTECTION FROM CONDENSATE, WATER AND FLUE GAS TEMPERATURE. NON–SLIP TYPE JOINTS ARE NOT ACCEPTABLE.

C. THE SINGLE WALL STACK SHALL BE MADE OF AN INNER GAS CARRYING PIPE OF 20 GAUGE MINIMUM TYPE 316 STAINLESS STEEL. THE MATERIALS AND CONSTRUCTION OF THE MODULAR SECTIONS AND ACCESSORIES SHALL BE AS SPECIFIED BY THE TERMS OF THE PRODUCT'S UL LISTING.

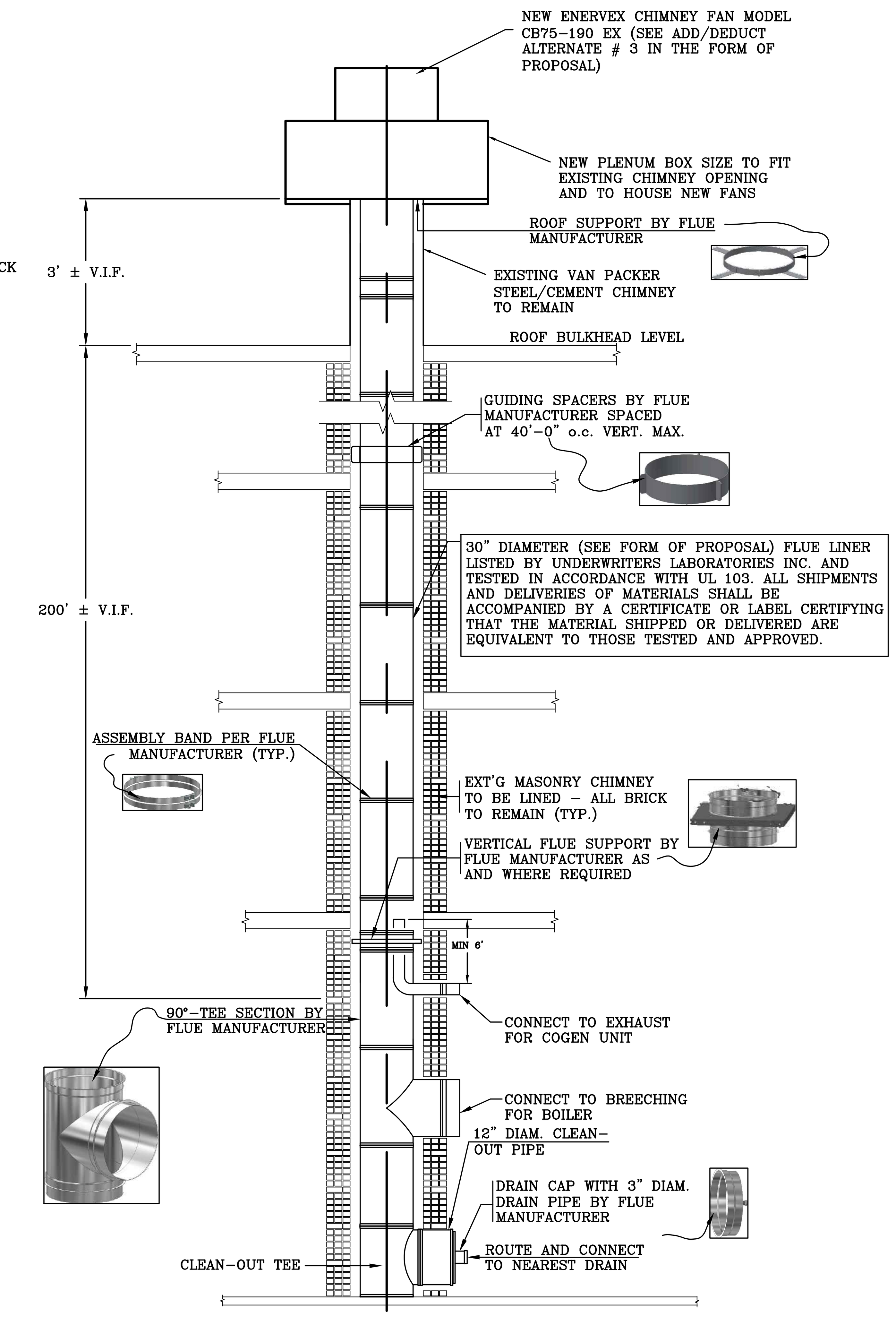
D. THE STACK SHALL BE WARRANTED AGAINST FUNCTIONAL FAILURE DUE TO DEFECTS IN MATERIAL AND MANUFACTURER'S WORKMANSHIP FOR A PERIOD OF 10 YEARS FROM THE DATE OF DELIVERY.

E. DRAWINGS SHOWING THE ACTUAL LAYOUT AND DRAWN TO SCALE SHALL BE PROVIDED BY THE MANUFACTURER FOR THE ENGINEER'S REVIEW AND APPROVAL PRIOR TO FABRICATION AND INSTALLATION. THE SYSTEM SHALL BE INSTALLED AS DESIGNED BY THE MANUFACTURER AND IN ACCORDANCE WITH THE TERMS OF THE MANUFACTURER'S 10 YEAR WARRANTY AND IN CONJUNCTION WITH SOUND ENGINEERING PRACTICE.

F. THE INNER DIAMETER FOR THE STACK SHALL BE VERIFIED BY THE MANUFACTURER'S COMPUTATIONS. THE COMPUTATION SHALL BE TECHNICALLY SOUND, SHALL FOLLOW ASHRAE CALCULATION METHODS AND INCORPORATE THE SPECIFIC FLOW CHARACTERISTICS OF THE INNER PIPE.

G. THE STACK SYSTEM SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. THE JOINING OF PIPE SECTIONS MUST BE MADE USING THE ASSEMBLY BAND, THE FINISHING BAND AND THE APPROPRIATE SEALING MATERIAL. ROOF PENETRATIONS SHALL BE SUITABLE FOR A COMBUSTIBLE ROOF AND SHALL BE ACCORDING TO THE MANUFACTURER'S DETAIL DRAWINGS AND INSTALLATION INSTRUCTIONS.

H. WHEN INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS THE STACK AND ITS SUPPORTING SYSTEM SHALL RESIST SIDE LOADS AT LEAST 1.5 TIMES THE WEIGHT PER FOOT OF PIPING.



UL LISTED CHIMNEY LINER ELEVATION DETAILS
(ADD ALTERNATE – SEE FORM OF PROPOSAL)

NTS

INSPECTIONS:

PURSUANT TO SECTION BC 1704.24, THE INSTALLATION OF RELINING SYSTEMS DESCRIBED IN THIS BULLETIN SHALL BE SUBJECT TO SPECIAL INSPECTION REQUIREMENTS OF CHAPTER 17 OF THE BUILDING CODE AND DEPARTMENT RULES COVERING SPECIAL INSPECTION

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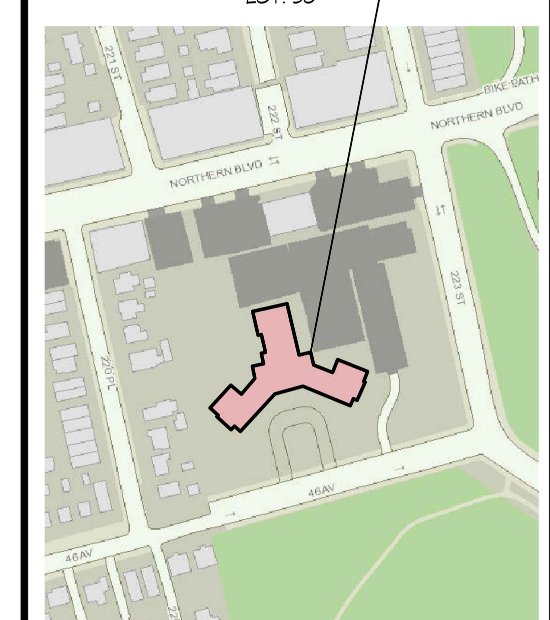
SITE PLAN

220-55 46 AVENUE
BAYSIDE, NY 11361
13 STORY BUILDING
BLOCK: 7414
LOT: 50



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CLIENT
LAKESIDE TOWERS CORP.
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP

DRAWINGS TITLE
MECHANICAL DETAILS

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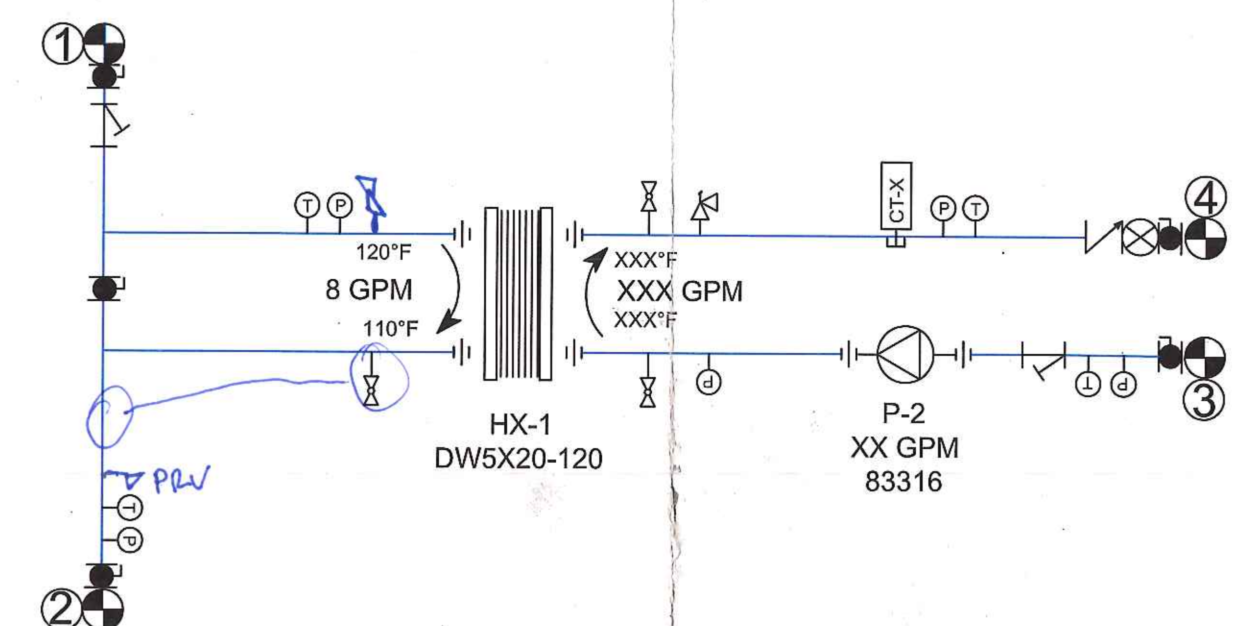
PIPING SYMBOLS

- NEW CONNECTION
- #'D PIPING CONNECTION
- BALL VALVE
- TRIPLE DUTY VALVE
- BALANCE VALVE
- CHECK VALVE
- STRAINER
- UNION
- BOILER DRAIN
- BALL VALVE w/DRAIN
- PRESSURE RELIEF
- AIR SCOOP w/VENT
- VENT w/SHUTOFF
- PRESSURE GAUGE
- THERMOMETER
- FLEX CONNECTION
- PRESSURE REDUCING VALVE
- MOTORIZED 3-WAY VALVE
- MOTORIZED 2-WAY VALVE
- FLOW METER
- TECOGEN THERMISTOR
- RADIATOR THERMOSTAT
- BTU TEMP SENSOR
- THERMOSTATIC VALVE

1INCH COPPER PIPING



TECOGENS COORDINATION DRAWING IS DEVELOPED TO ASSIST WITH PROPER SYSTEM INTEGRATION. TECOGEN ASSUMES THAT ALL DRAWINGS AND COMMENTS ARE REVIEWED BY THE ENGINEER OF RECORD FOR CODE COMPLIANCY. THE INSTALLING CONTRACTOR ASSUMES ALL RISK IN COORDINATING THIS DRAWING WITH THE ENGINEERED CONSTRUCTION DRAWINGS. ANY AND ALL CONFLICTS ARE TO BE REVIEWED BY ALL PARTIES. TECOGEN DOES NOT WARRANT ALL COORDINATING ITEMS ARE ADDRESSED IN THIS DRAWING OR REVIEW, BUT HAS MADE ITS BEST EFFORTS TO CATCH ALL FUNDEMENTAL ISSUES. TECOGEN SHALL NOT BEAR ANY COST ADJUSTMENTS AS A RESULT OF THIS COORDINATING EFFORT.

1. CONTRACTOR TO COORDINATE WITH ENGINEER ANY DESCREPANCIES BETWEEN DRAWING SETS. A DOCUMENTED RFI SHOULD BE PREPARED AND SENT TO ENGINEER ADDRESSING ANY ISSUES, TECOGEN SHOULD BE COPIED.
2. MECHANICAL CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS IN ACCORDANCE WITH STATE AND LOCAL CODES, RULES AND REGULATIONS.
3. INSTALL ALL PIPING AND EQUIPMENT IN ACCORDANCE WITH ALL STATE AND LOCAL CODES, RULES AND REGULATIONS. FINAL INSPECTION REQUIRED PRIOR TO START UP.
4. COORDINATE ALL PIPING WITH ENGINEER, BUILDING OWNER, AND ALL OTHER TRADES. ALL PIPING SHALL BE INSTALLED AS HIGH AS PRACTICAL ABOVE FINISHED FLOOR. PIPING SHOULD BE CONFIGURED AS TO AVOID RUNNING ABOVE THE EQUIPMENT.
5. ALL PIPING SHALL BE INSTALLED SO AS TO AVOID BULLHEAD TEE CONFIGURATIONS WITH BOTH CONVERGING AND DIVERGING FLOW.
6. ALL NEW LIQUID PIPING, HEAT EXCHANGERS, AND DISTURDED AREAS TO BE INSULATED.
7. BACK OUT AND RESEAT ALL STRAINER BUSHINGS PRIOR TO FILLING TO AVOID SIEZING.
8. VALVES, DRAINS, GAUGES, WELLS, ETC AS SHOWN ON P&ID NEED TO BE INSTALLED FOR SERVICE AND TROUBLESHOOTING. FAILIARE TO DO SO WILL PREVENT START UP.
9. INSTALL AUTOMATIC AIRVENTS (H20 SYSTEMS) AND MANUAL AIR VENTS (GLYCOL SYSTEMS) AT ALL SYSTEM HIGH POINTS AND DRAINS AT ALL SYSTEM LOW POINTS.
10. INSTALL TECOGEN SUPPLIED THERMISTORS AND WELLS IN NEW & EXISTING PIPING FOR SYSTEM CONTROL AND MONITORING.
11. PROVIDE TEMPERATURE AND PRESSURE GAUGES AT INLET AND OUTLET PIPING CONFIGURATIONS TO ALL EQUIPMENT.
12. ENGAGE A FACTORY AUTHORIZED SERVICE REPRESENTATIVE TO PERFORM START UP SERVICE ON COGEN EQUUIPMENT. TEST, INSPECT, AND ADJUST COMPONENTS FOR PROPER EQUIPMENT OPERATION.
13. FLUSH SYSTEM OF ALL IMPURITIES PRIOR TO OPERATION. WHEN FILLING THE SYSTEM, BE SURE TO BLEED AS MUCH AIR AS POSSIBLE AT HIGH POINTS. CRACK PUMP FITTINGS OR PLUGS TO ENSURE THE PUMP IS FLODDED PRIOR TO OPERATION. REFER TO PUMP I&O PRIOR TO START UP.

Tecogen
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(781) 466-6400
WWW.TECOGEN.COM

2-20-19
MECHANICAL ENGINEER

ELECTRICAL ENGINEER

PE STAMP/SEAL

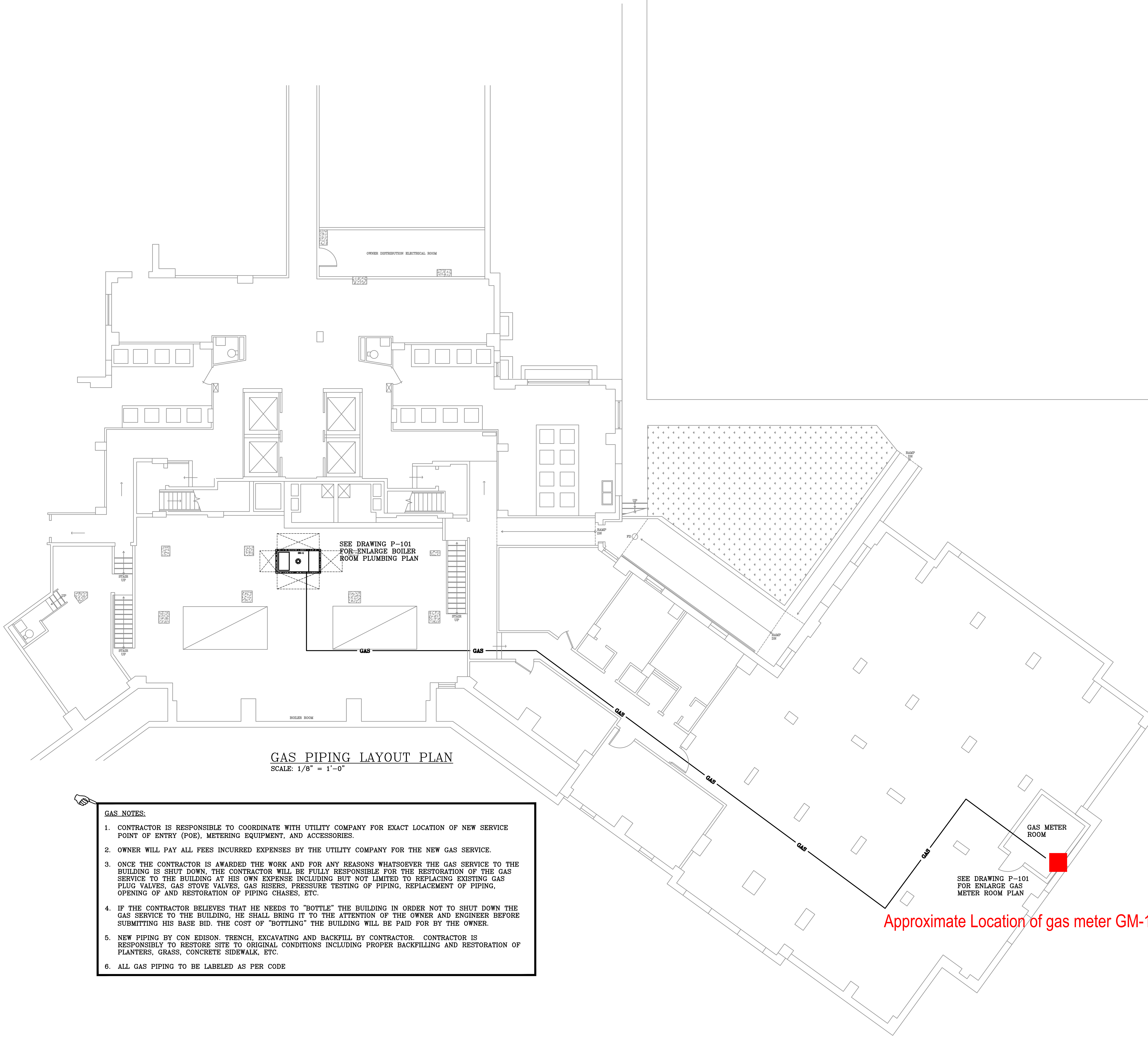
DATE	REV	DESCRIPTION
2/20/19	0	FOR MFG

LAKESIDE
83324
PROJECT

2/20/19	BJGE
DATE	DRAWN BY

LOAD MODULE PIPING
DRAWING TITLE

P&ID
DRAWING NUMBER



GAS PIPING LAYOUT PLAN
SCALE: 1/8" = 1'-0"

GAS NOTES:

1. CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH UTILITY COMPANY FOR EXACT LOCATION OF NEW SERVICE POINT OF ENTRY (POE), METERING EQUIPMENT, AND ACCESSORIES.
2. OWNER WILL PAY ALL FEES INCURRED EXPENSES BY THE UTILITY COMPANY FOR THE NEW GAS SERVICE.
3. ONCE THE CONTRACTOR IS AWARDED THE WORK AND FOR ANY REASONS WHATSOEVER THE GAS SERVICE TO THE BUILDING IS SHUT DOWN, THE CONTRACTOR WILL BE FULLY RESPONSIBLE FOR THE RESTORATION OF THE GAS SERVICE TO THE BUILDING AT HIS OWN EXPENSE INCLUDING BUT NOT LIMITED TO REPLACING EXISTING GAS PLUG VALVES, GAS STOVE VALVES, GAS RISERS, PRESSURE TESTING OF PIPING, REPLACEMENT OF PIPING, OPENING OF AND RESTORATION OF PIPING CHASES, ETC.
4. IF THE CONTRACTOR BELIEVES THAT HE NEEDS TO "BOTTLE" THE BUILDING IN ORDER NOT TO SHUT DOWN THE GAS SERVICE TO THE BUILDING, HE SHALL BRING IT TO THE ATTENTION OF THE OWNER AND ENGINEER BEFORE SUBMITTING HIS BASE BID. THE COST OF "BOTTLING" THE BUILDING WILL BE PAID FOR BY THE OWNER.
5. NEW PIPING BY CON EDISON. TRENCH, EXCAVATING AND BACKFILL BY CONTRACTOR. CONTRACTOR IS RESPONSIBLY TO RESTORE SITE TO ORIGINAL CONDITIONS INCLUDING PROPER BACKFILLING AND RESTORATION OF PLANTERS, GRASS, CONCRETE SIDEWALK, ETC.
6. ALL GAS PIPING TO BE LABELED AS PER CODE

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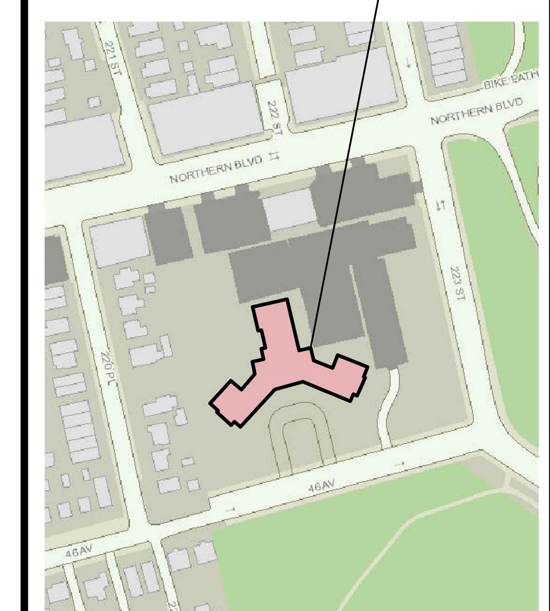
SITE PLAN

220-55 46 AVENUE
BAYSIDE, NY 11361
13 STORY BUILDING
BLOCK: 7474
LOT: 50



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PROJECT
LAKESIDE TOWERS CHP

DRAWINGS TITLE
GAS SERVICE PIPING & LAYOUT PLAN

DRAWN BY	CHECKED BY	PROJECT NO.
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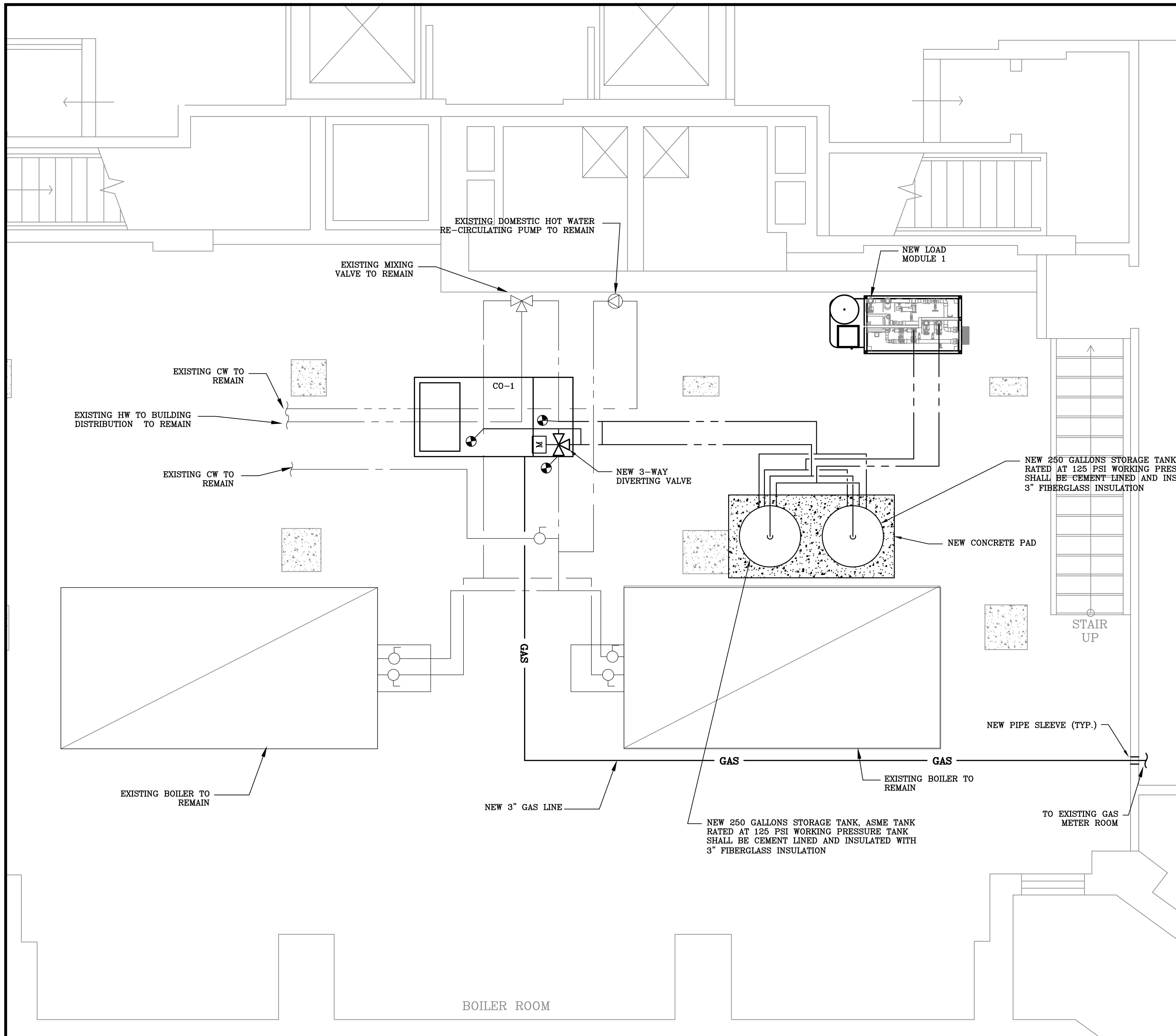
SHEET 7 OF 14

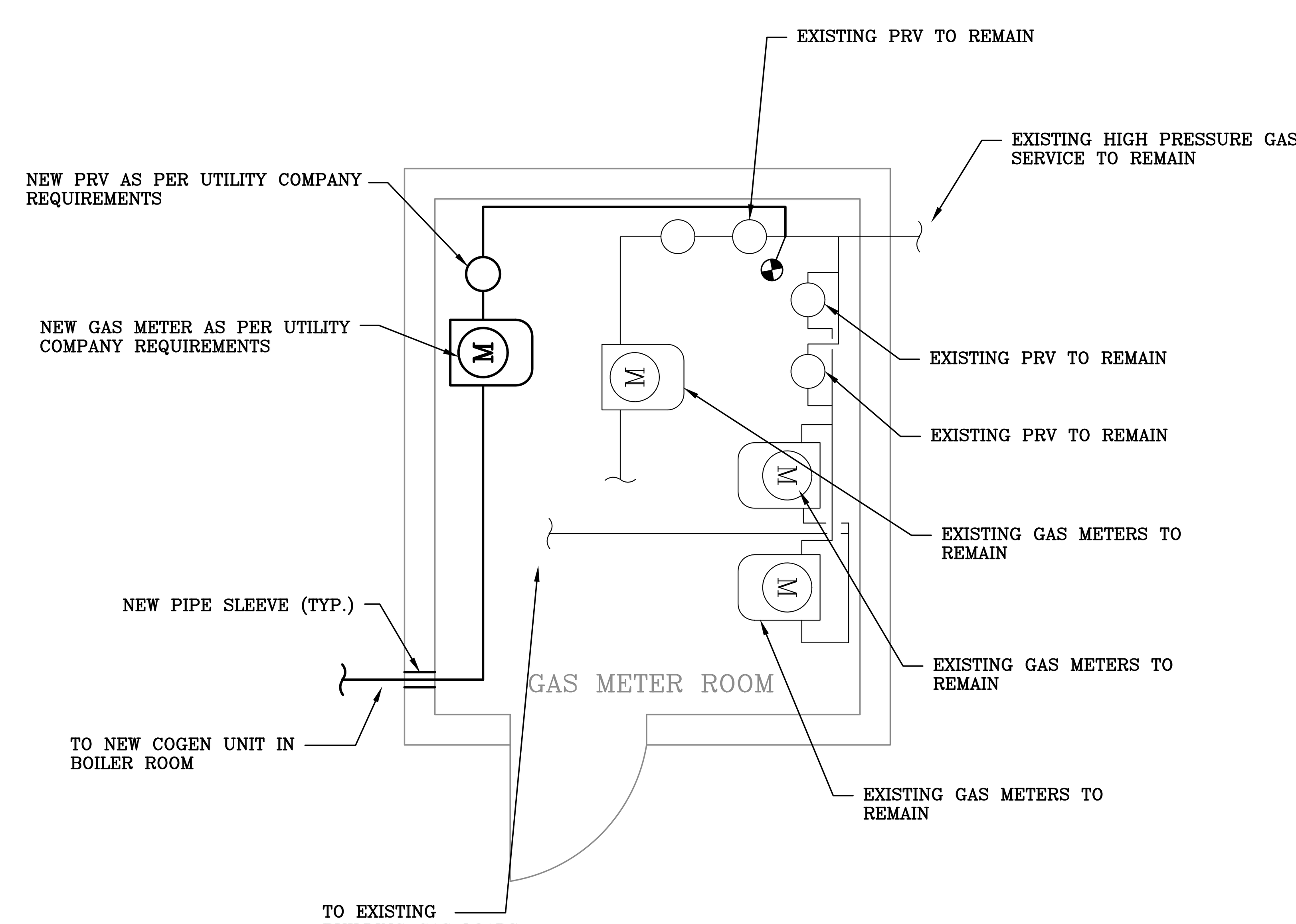


NOTES:

- PROVIDE NEW INSULATION FOR ALL NEW AND AFFECT EXISTING HW, HWR & CW PIPING

PARTIAL CELLAR FLOOR BOILER ROOM PLUMBING PLAN

SCALE: 3/8" = 1'-0"



CELLAR FLOOR GAS METER ROOM PLAN

SCALE: 3/8" = 1'-0"

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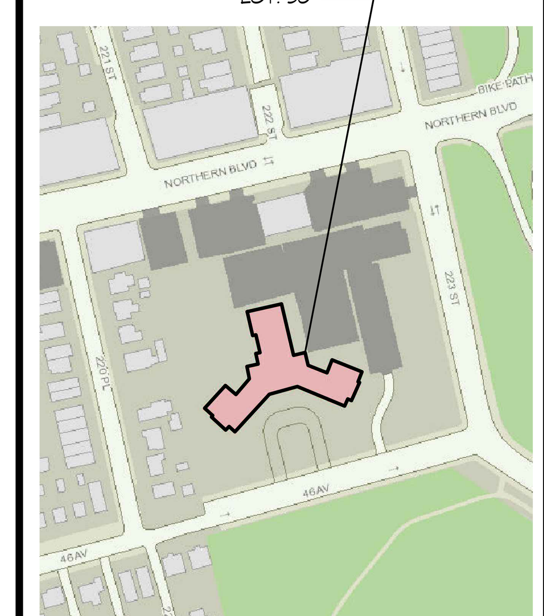
SITE PLAN

220-55 46 AVENUE
BAYSIDE, NY 11361
13 STORY BUILDING
BLOCK: 7474
LOT: 50



NO.	DATE	ISSUE/REV.
1	08/31/2017	50% CD - FOR CLIENT REVIEW

CLIENT
LAKESIDE TOWERS CORP.
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP

DRAWINGS TITLE
PARTIAL CELLAR FLOOR PLUMBING PLAN & GAS METER ROOM PLAN

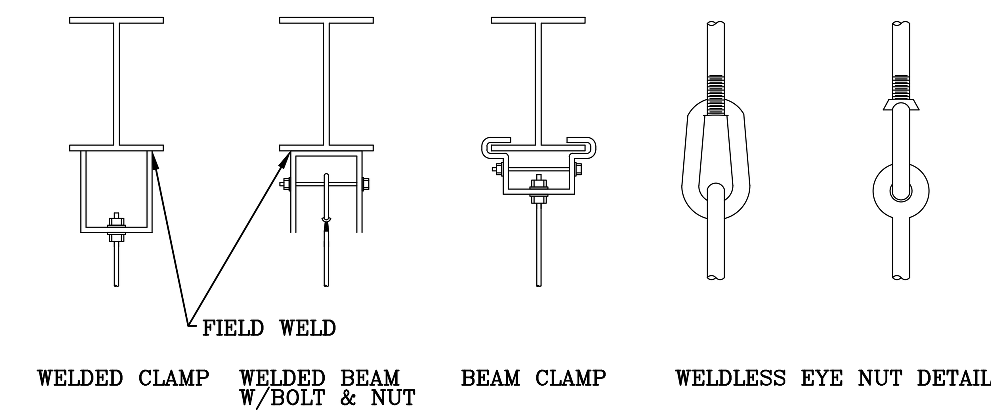
DRAWN BY	CHECKED BY	PROJECT NO.
GB	NR	2017-600

DATE
08/28/17

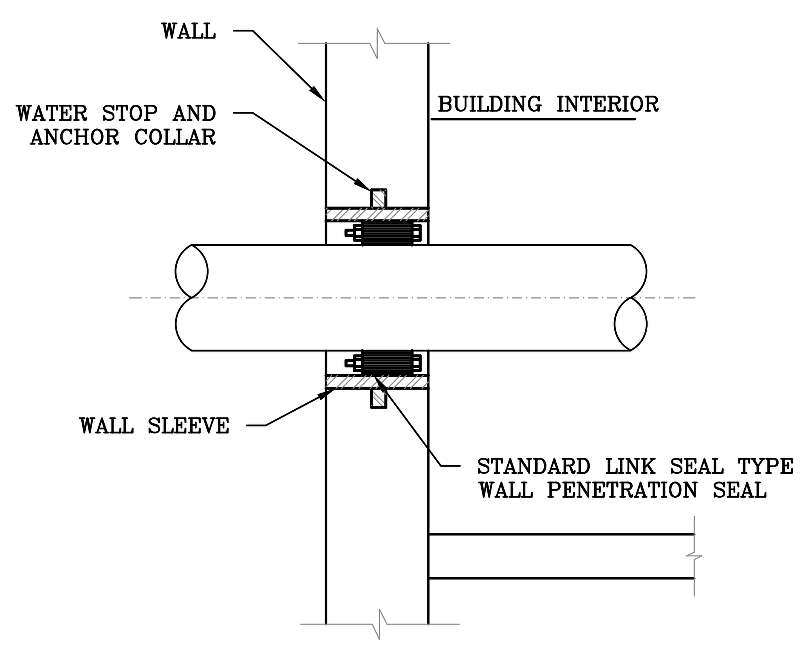
DRAWING NO.

P-102.00

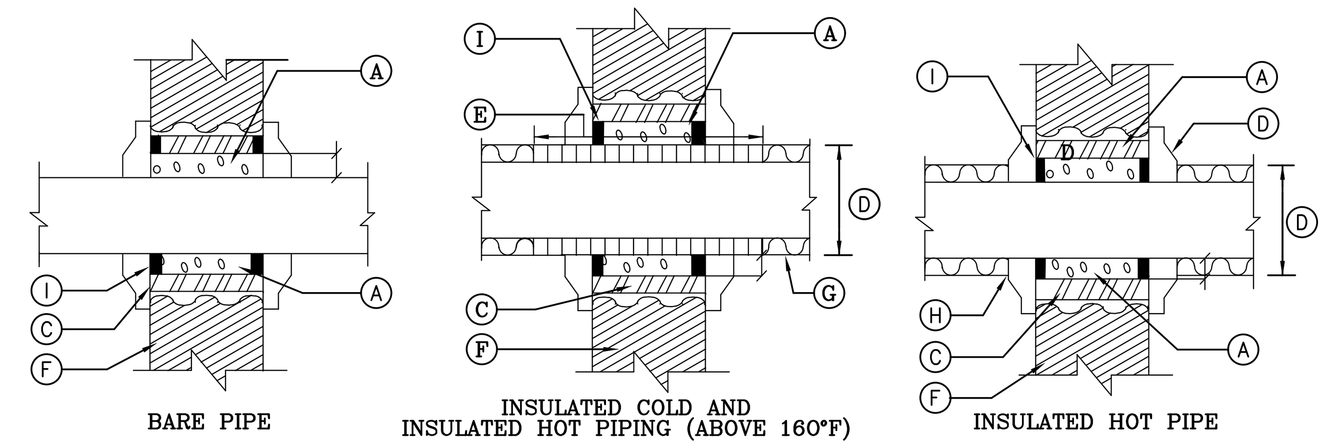
SHEET 8 OF 14



ACCEPTABLE ATTACHMENT TO STRUCTURE
NTS



PIPING WALL PENETRATION DETAIL
NTS



(A) ALL SPACES PACKED FULL DEPTH WITH MINERAL WOOL OR OTHER EQUALLY APPROVED FIRE RESISTIVE MATERIAL (ASBESTOS OR FIBERGLASS SHALL NOT BE USED)

(C) SLEEVE

(D) DIAMETER OF INSULATED PIPE

(E) ANHYDROUS CALCIUM SILICATE INSULATION THRU SLEEVE

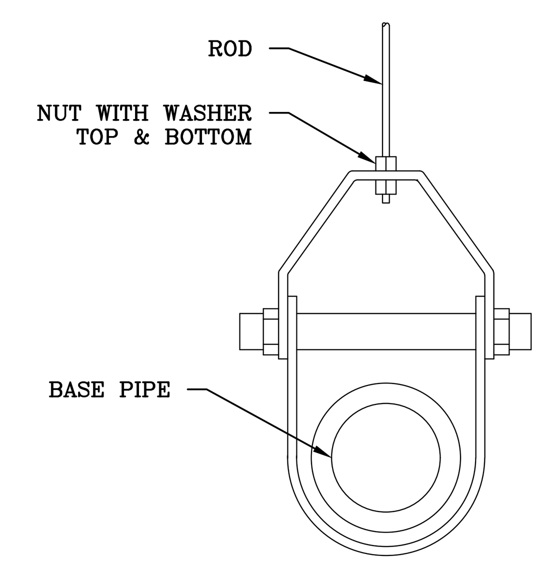
(F) FIRE RATED PARTITION WALL OR FLOOR

(G) FIBERGLASS INSULATION

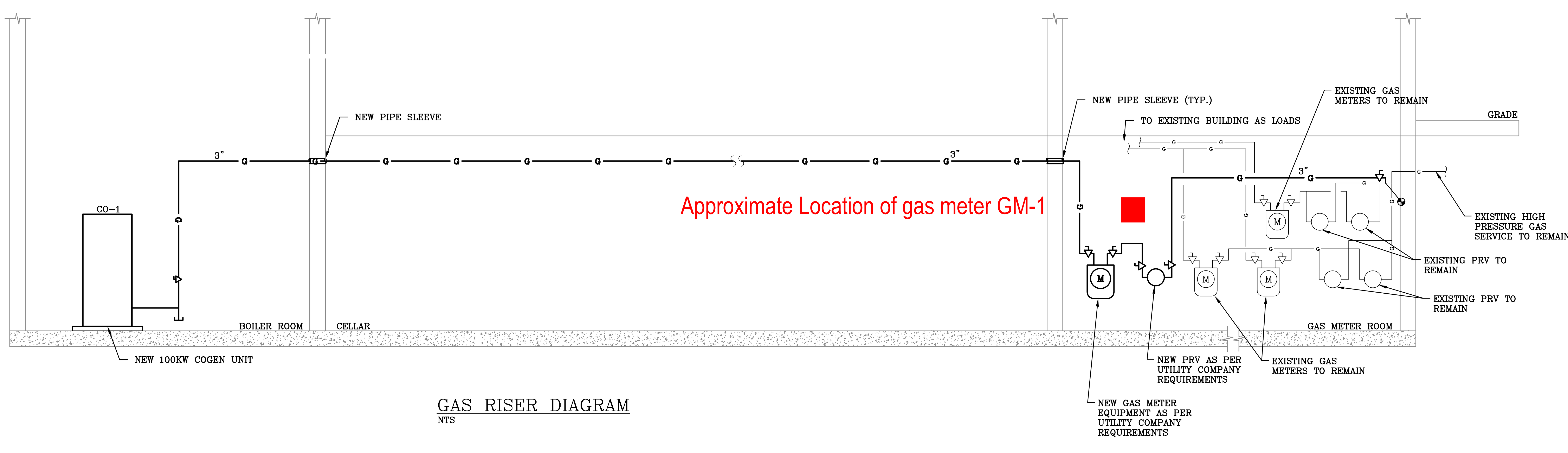
(H) TERMINATE INSULATION AT ESCUTCHEON

(I) 1/2" DEPTH FIRE STOP FINISH SEALANT

DETAIL OF PIPING PIERCING FIRE RATED PARTITIONS, WALLS AND FLOORS
NTS



PIPE HANGER
NTS



GAS RISER DIAGRAM
NTS

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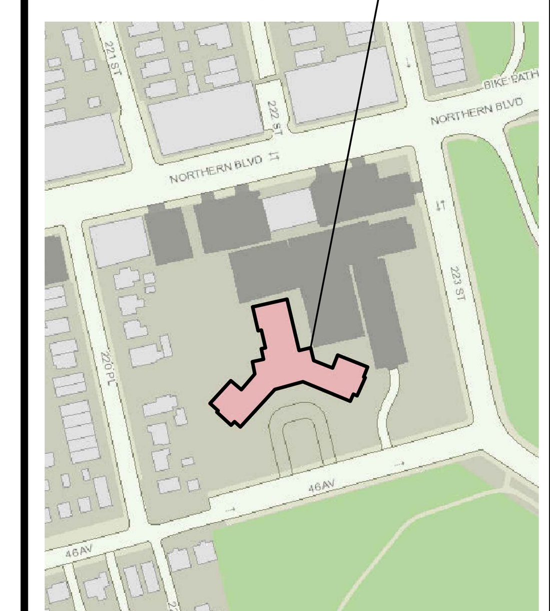
SITE PLAN

220-55 46 AVENUE
BAYSIDE, NY 11361
13 STORY BUILDING
BLOCK: 7414
LOT: 30



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CLIENT
LAKESIDE TOWERS CORP.
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP

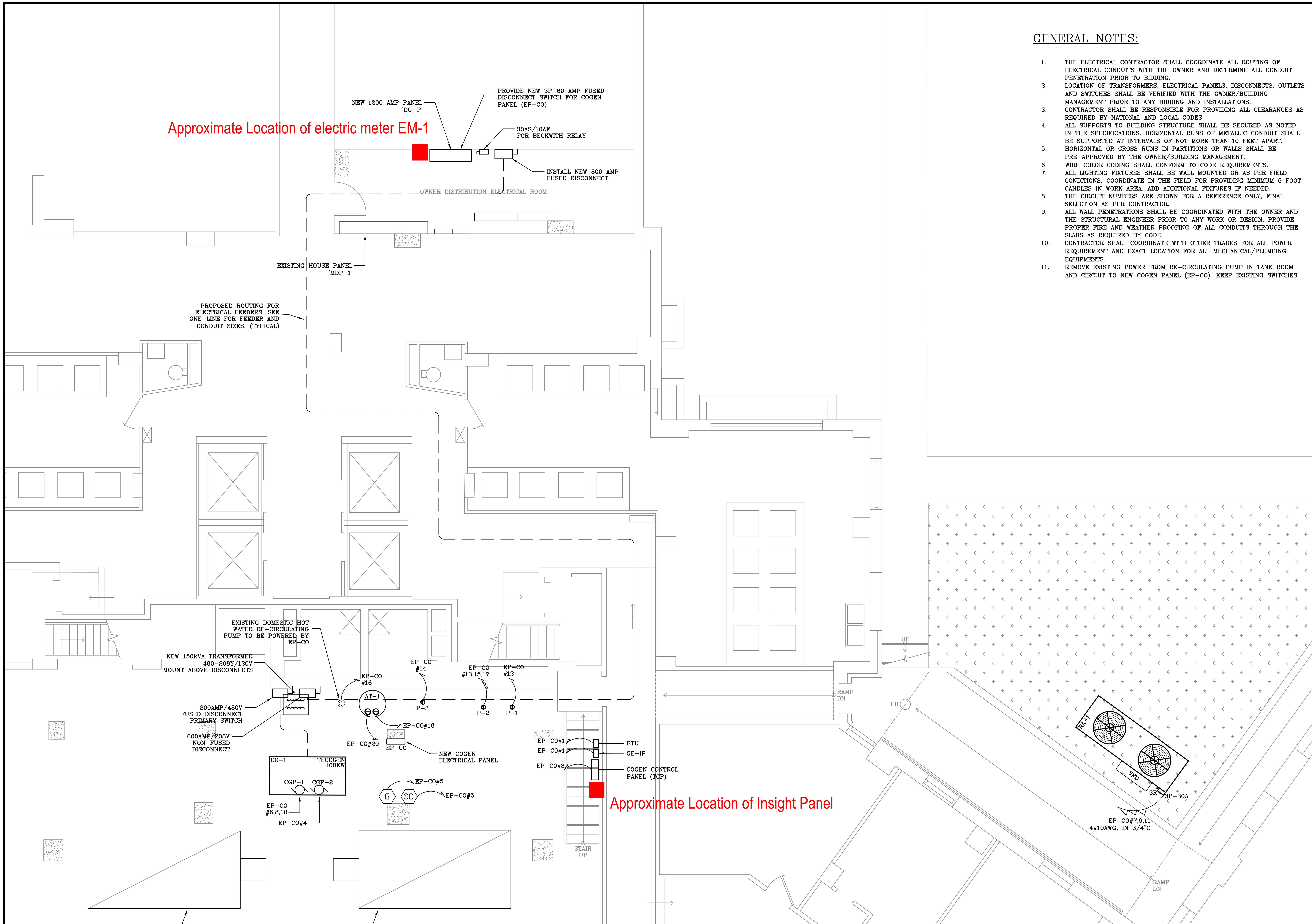
DRAWINGS TITLE
PLUMBING DETAILS AND GAS RISER DIAGRAM

DRAWN BY	CHECKED BY	PROJECT NO.
GB	NR	2017-600

DATE
08/28/17

DRAWING NO.
P-201.00

SHEET 9 14



PARTIAL CELLAR ELECTRICAL PLAN
SCALE: 1/4" = 1'-0"

GENERAL NOTES:

1. THE ELECTRICAL CONTRACTOR SHALL COORDINATE ALL ROUTING OF ELECTRICAL CONDUITS WITH THE OWNER AND DETERMINE ALL CONDUIT PENETRATION PRIOR TO BIDDING.
2. LOCATION OF TRANSFORMERS, ELECTRICAL PANELS, DISCONNECTS, OUTLETS AND SWITCHES SHALL BE VERIFIED WITH THE OWNER/BUILDING MANAGEMENT PRIOR TO ANY BIDDING AND INSTALLATIONS.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL CLEARANCES AS REQUIRED BY NATIONAL AND LOCAL CODES.
4. ALL SUPPORTS TO BUILDING STRUCTURE SHALL BE SECURED AS NOTED IN THE SPECIFICATIONS. HORIZONTAL RUNS OF METALLIC CONDUIT SHALL BE SUPPORTED AT INTERVALS OF NOT MORE THAN 10 FEET APART.
5. HORIZONTAL OR CROSS RUNS IN PARTITIONS OR WALLS SHALL BE PRE-APPROVED BY THE OWNER/BUILDING MANAGEMENT.
6. WIRE COLOR CODING SHALL CONFORM TO CODE REQUIREMENTS.
7. ALL LIGHTING FIXTURES SHALL BE WALL MOUNTED OR AS PER FIELD CONDITIONS. COORDINATE IN THE FIELD FOR PROVIDING MINIMUM 5 FOOT CANDLES IN WORK AREA. ADD ADDITIONAL FIXTURES IF NEEDED.
8. THE CIRCUIT NUMBERS ARE SHOWN FOR A REFERENCE ONLY, FINAL SELECTION AS PER CONTRACTOR.
9. ALL WALL PENETRATIONS SHALL BE COORDINATED WITH THE OWNER AND THE STRUCTURAL ENGINEER PRIOR TO ANY WORK OR DESIGN. PROVIDE PROPER FIRE AND WEATHER PROOFING OF ALL CONDUITS THROUGH THE SLABS AS REQUIRED BY CODE.
10. CONTRACTOR SHALL COORDINATE WITH OTHER TRADES FOR ALL POWER REQUIREMENT AND EXACT LOCATION FOR ALL MECHANICAL/PLUMBING EQUIPMENTS.
11. REMOVE EXISTING POWER FROM RE-CIRCULATING PUMP IN TANK ROOM AND CIRCUIT TO NEW COGEN PANEL (EP-CO). KEEP EXISTING SWITCHES.

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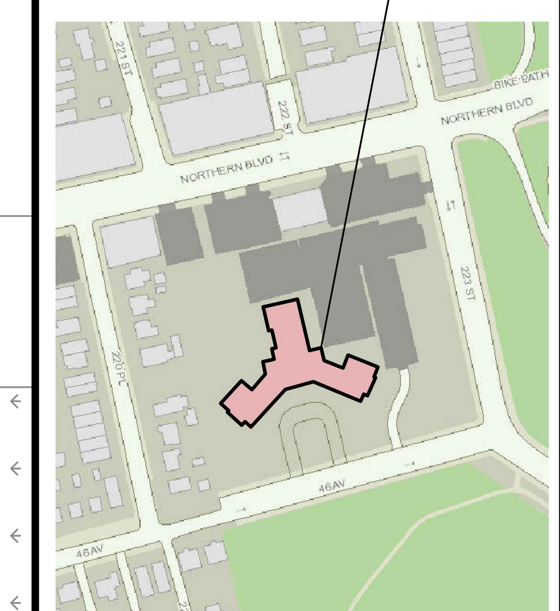
SITE PLAN

220-55 46 AVENUE
BAYSIDE, NY 11361
13 STORY BUILDING
BLOCK: 7474
LOT: 50



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CLIENT
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220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP

DRAWINGS TITLE
PARTIAL CELLAR ELECTRICAL PLAN

DRAWN BY	CHECKED BY	PROJECT NO.
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DATE
08/28/17

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COGEN SYSTEM NOTES:

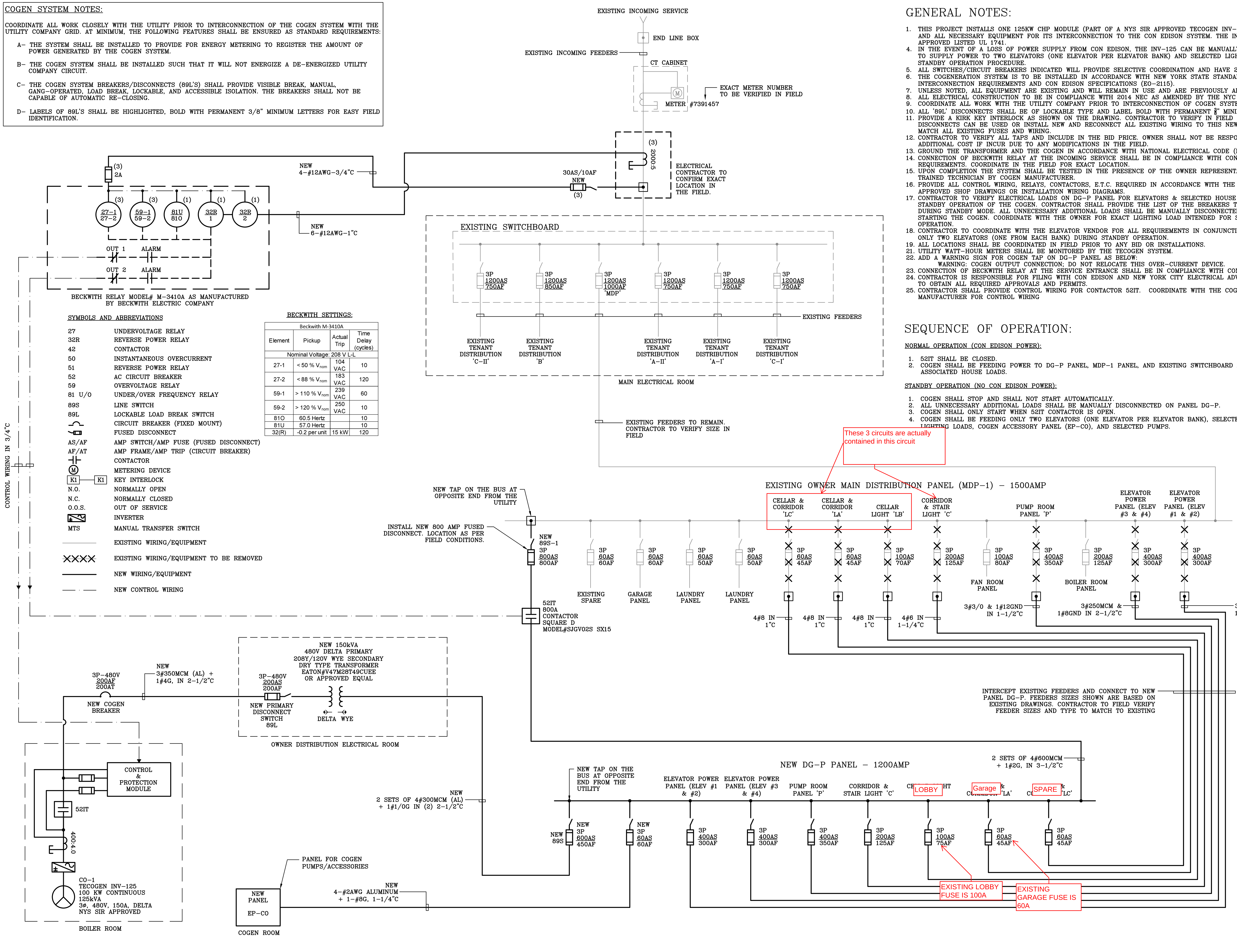
COORDINATE ALL WORK CLOSELY WITH THE UTILITY PRIOR TO INTERCONNECTION OF THE COGEN SYSTEM WITH THE UTILITY COMPANY GRID. AT MINIMUM, THE FOLLOWING FEATURES SHALL BE ENSURED AS STANDARD REQUIREMENTS:

A– THE SYSTEM SHALL BE INSTALLED TO PROVIDE FOR ENERGY METERING TO REGISTER THE AMOUNT OF POWER GENERATED BY THE COGEN SYSTEM.

B– THE COGEN SYSTEM SHALL BE INSTALLED SUCH THAT IT WILL NOT ENERGIZE A DE–ENERGIZED UTILITY COMPANY CIRCUIT.

C– THE COGEN SYSTEM BREAKERS/DISCONNECTS (89L'S) SHALL PROVIDE VISIBLE BREAK, MANUAL, GANG–OPERATED, LOAD BREAK, LOCKABLE, AND ACCESSIBLE ISOLATION. THE BREAKERS SHALL NOT BE CAPABLE OF AUTOMATIC RE–CLOSING.

D– LABELS OF 89L'S SHALL BE HIGHLIGHTED, BOLD WITH PERMANENT 3/8" MINIMUM LETTERS FOR EASY FIELD IDENTIFICATION.



SYMBOLS AND ABBREVIATIONS

27	UNDERVOLTAGE RELAY
32R	REVERSE POWER RELAY
42	CONTACTOR
50	INSTANTANEOUS OVERCURRENT
51	REVERSE POWER RELAY
52	AC CIRCUIT BREAKER
59	OVERVOLTAGE RELAY
81 U/O	UNDER/OVER FREQUENCY RELAY
89S	LINE SWITCH
89L	LOCKABLE LOAD BREAK SWITCH
	CIRCUIT BREAKER (FIXED MOUNT)
	FUSED DISCONNECT
AS/AF	AMP SWITCH/AMP FUSE (FUSED DISCONNECT)
AF/AT	AMP FRAME/AMP TRIP (CIRCUIT BREAKER)
	CONTACTOR
M	METERING DEVICE
K1 K1	KEY INTERLOCK
N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED
O.O.S.	OUT OF SERVICE
	INVERTER
MTS	MANUAL TRANSFER SWITCH
	EXISTING WIRING/EQUIPMENT
XXXX	EXISTING WIRING/EQUIPMENT TO BE REMOVED
	NEW WIRING/EQUIPMENT
	NEW CONTROL WIRING

BECKWITH SETTINGS:

Beckwith M-3410A			
Element	Pickup	Actual Trip	Time Delay (cycles)
Nominal Voltage: 208 V L-L			
27-1	< 50 % V_{nom}	104 VAC	10
27-2	< 88 % V_{nom}	183 VAC	120
59-1	> 110 % V_{nom}	239 VAC	60
59-2	> 120 % V_{nom}	250 VAC	10
81O	60.5 Hertz		10
81U	57.0 Hertz		10
32(R)	-0.2 per unit	15 kW	120

GENERAL NOTES:

1. THIS PROJECT INSTALLS ONE 125KW CHP MODULE (PART OF A NYS SIR APPROVED TECOGEN INV–125 PACKAGED) AND ALL NECESSARY EQUIPMENT FOR ITS INTERCONNECTION TO THE CON EDISON SYSTEM. THE INVERTER IS APPROVED LISTED UL 1741.
4. IN THE EVENT OF A LOSS OF POWER SUPPLY FROM CON EDISON, THE INV–125 CAN BE MANUALLY TRANSFERRED TO SUPPLY POWER TO TWO ELEVATORS (ONE ELEVATOR PER ELEVATOR BANK) AND SELECTED LIGHTING LOADS. SEE STANDBY OPERATION PROCEDURE.
5. ALL SWITCHES/CIRCUIT BREAKERS INDICATED WILL PROVIDE SELECTIVE COORDINATION AND HAVE 200 kAIC RATING.
6. THE COGENERATION SYSTEM IS TO BE INSTALLED IN ACCORDANCE WITH NEW YORK STATE STANDARD INTERCONNECTION REQUIREMENTS AND CON EDISON SPECIFICATIONS (EO–2115).
7. UNLESS NOTED, ALL EQUIPMENT ARE EXISTING AND WILL REMAIN IN USE AND ARE PREVIOUSLY APPROVED.
8. ALL ELECTRICAL CONSTRUCTION TO BE IN COMPLIANCE WITH 2014 NEC AS AMENDED BY THE NYC ADVISORY BOARD.
9. COORDINATE ALL WORK WITH THE UTILITY COMPANY PRIOR TO INTERCONNECTION OF COGEN SYSTEM.
10. ALL '89L' DISCONNECTS SHALL BE OF LOCKABLE TYPE AND LABEL BOLD WITH PERMANENT ⅜" MINIMUM LETTERS.
11. PROVIDE A KIRK KEY INTERLOCK AS SHOWN ON THE DRAWING. CONTRACTOR TO VERIFY IN FIELD IF EXISTING DISCONNECTS CAN BE USED OR INSTALL NEW AND RECONNECT ALL EXISTING WIRING TO THIS NEW DISCONNECT. MATCH ALL EXISTING FUSES AND WIRING.
12. CONTRACTOR TO VERIFY ALL TAPS AND INCLUDE IN THE BID PRICE. OWNER SHALL NOT BE RESPONSIBLE FOR ANY ADDITIONAL COST IF INCUR DUE TO ANY MODIFICATIONS IN THE FIELD.
13. GROUND THE TRANSFORMER AND THE COGEN IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE (NEC) SECTION 250.
14. CONNECTION OF BECKWITH RELAY AT THE INCOMING SERVICE SHALL BE IN COMPLIANCE WITH CON EDISON REQUIREMENTS. COORDINATE IN THE FIELD FOR EXACT LOCATION.
15. UPON COMPLETION THE SYSTEM SHALL BE TESTED IN THE PRESENCE OF THE OWNER REPRESENTATIVE, FACTORY TRAINED TECHNICIAN BY COGEN MANUFACTURER.
16. PROVIDE ALL CONTROL WIRING, RELAYS, CONTACTORS, E.T.C. REQUIRED IN ACCORDANCE WITH THE MANUFACTURER'S APPROVED SHOP DRAWINGS OR INSTALLATION WIRING DIAGRAMS.
17. CONTRACTOR TO VERIFY ELECTRICAL LOADS ON DG–P PANEL FOR ELEVATORS & SELECTED HOUSE LIGHTING FOR STANDBY OPERATION OF THE COGEN. CONTRACTOR SHALL PROVIDE THE LIST OF THE BREAKERS TO TURN OFF DURING STANDBY MODE. ALL UNNECESSARY ADDITIONAL LOADS SHALL BE MANUALLY DISCONNECTED BEFORE STARTING THE COGEN. COORDINATE WITH THE OWNER FOR EXACT LIGHTING LOAD INTENDED FOR STANDBY OPERATION.
18. CONTRACTOR TO COORDINATE WITH THE ELEVATOR VENDOR FOR ALL REQUIREMENTS IN CONJUNCTION OF OPERATING ONLY TWO ELEVATORS (ONE FROM EACH BANK) DURING STANDBY OPERATION.
19. ALL LOCATIONS SHALL BE COORDINATED IN FIELD PRIOR TO ANY BID OR INSTALLATIONS.
21. UTILITY WATT–HOUR METERS SHALL BE MONITORED BY THE TECOGEN SYSTEM.
22. ADD A WARNING SIGN FOR COGEN TAP ON DG–P PANEL AS BELOW:
    WARNING: COGEN OUTPUT CONNECTION; DO NOT RELOCATE THIS OVER–CURRENT DEVICE.
23. CONNECTION OF BECKWITH RELAY AT THE SERVICE ENTRANCE SHALL BE IN COMPLIANCE WITH CON EDISON.
24. CONTRACTOR IS RESPONSIBLE FOR FILING WITH CON EDISON AND NEW YORK CITY ELECTRICAL ADVISORY BOARD AND TO OBTAIN ALL REQUIRED APPROVALS AND PERMITS.
25. CONTRACTOR SHALL PROVIDE CONTROL WIRING FOR CONTACTOR 52IT. COORDINATE WITH THE COGEN MANUFACTURER FOR CONTROL WIRING

SEQUENCE OF OPERATION:

NORMAL OPERATION (CON EDISON POWER):

1. 52IT SHALL BE CLOSED.
2. COGEN SHALL BE FEEDING POWER TO DG–P PANEL, MDP–1 PANEL, AND EXISTING SWITCHBOARD AND OTHER ASSOCIATED HOUSE LOADS.

STANDBY OPERATION (NO CON EDISON POWER):

1. COGEN SHALL STOP AND SHALL NOT START AUTOMATICALLY.
2. ALL UNNECESSARY ADDITIONAL LOADS SHALL BE MANUALLY DISCONNECTED ON PANEL DG–P.
3. COGEN SHALL ONLY START WHEN 52IT CONTACTOR IS OPEN.
4. COGEN SHALL BE FEEDING ONLY TWO ELEVATORS (ONE ELEVATOR PER ELEVATOR BANK), SELECTED EMERGENCY LIGHTING LOADS, COGEN ACCESSORY PANEL (EP–CO), AND SELECTED PUMPS.

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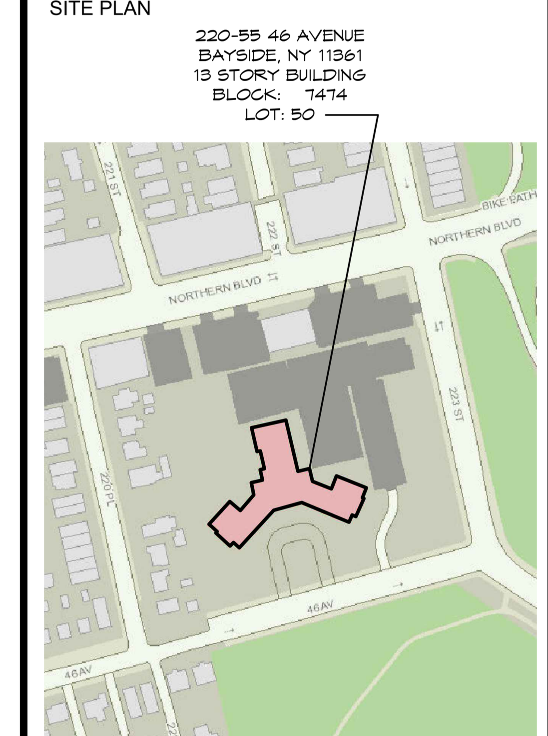
SITE PLAN



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1	08/31/2017	50% CD - FOR CLIENT REVIEW
2	10/24/2017	BID SET
3	12/12/2017	BID SET
4	12/28/2017	BID SET

CLIENT
LAKESIDE TOWERS
220-55 A6 AVENUE
BAYSIDE, NY 11361

PROJECT
LAKESIDE TOWERS CHP AND RELATED WORK

DRAWINGS TITLE
COGEN ONE LINE DIGRAM

DRAWN BY	CHECKED BY	PROJECT NO.
GB	NR	2017-600

DATE 12/28/17

DRAWING NO.

E-200.00

Appendix B

Cut Sheets for Key Sensors and Instruments

ModMAG®
M-Series® | B-MAG Electromagnetic Flow Meters

M-Series® M5000

Electromagnetic Flow Meter

DESCRIPTION

Designed, developed and manufactured under strict quality standards, the M-Series M5000 electromagnetic meter features sophisticated, processor-based signal conversion with accuracies of ± 0.4%. Based on Faraday's Law of Induction, these meters can measure potable water, reclaimed water, ground water and clear, water-based applications that have minimal electrical conductivity.

The flow meter is a stainless steel tube lined with a non-conductive material. Outside the tube are two DC-powered electromagnetic coils positioned opposite each other. Perpendicular to the coils are two electrodes inserted into the flow tube. The energized coils create a magnetic field across the diameter of the pipe.

As a conductive fluid flows through the magnetic field, a voltage is induced across the electrodes. This voltage is proportional to the average flow velocity of the fluid and is measured by the two electrodes. This induced voltage is then amplified and digitally processed by the converter to produce an accurate analog or digital signal. The signal can then be used to indicate flow rate and totalization, or to communicate to remote sensors and controllers. In addition, the processor controls zero-flow stability, frequency outputs, serial communications, and other parameters.

With no moving parts in the flow stream, there is no pressure loss. Also, accuracy is not affected by temperature, pressure, viscosity or density and there is practically no maintenance required.

ELECTRODES

When looking from the end of the meter into the inside bore, the two measuring electrodes are positioned at three o'clock and nine o'clock. M5000 mag meters have an "empty pipe detection" feature. This is accomplished with a third electrode positioned in the meter between twelve o'clock and one o'clock.

If this electrode is not covered by fluid for a minimum five-second duration, the meter will display an "empty pipe detection" condition, send out an error message, if desired, and stop measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

The wide selection of liner and electrode materials helps provide maximum compatibility and minimum maintenance over a long operating period. The M5000 amplifier can be integrally mounted to the detector, or if necessary, mounted remotely. The amplifier is housed in a NEMA 4X (IP66) enclosure.

OPERATION

In addition to using grounding rings, a grounding electrode (fourth electrode) can be built into the meter during manufacturing to assure proper grounding. The position of this electrode is at five o'clock.

APPLICATION

The M5000 mag meter is designed for applications without power line access, where flow is continuous, and when indication of rate and totalization are required. The M5000 can accurately measure fluid flow—whether the fluid is water or a highly corrosive liquid, very viscous, contains a moderate amount of solids, or requires special handling. Today, electronic meters are successfully used in industries including potable water, reclaimed water, food and beverage, pharmaceutical and chemical.

FEATURES

- Available in sizes 0.50…24 in. (15…600 mm)
- Battery powered
- ± 0.4% of measured value ± 2 mm/s accuracy independent of fluid viscosity, density and temperature
- Unaffected by most solids contained in fluids
- Pulsed DC magnetic field for zero point stability
- No pressure loss for low operational costs
- Corrosion resistant liners for long life
- Calibrated in state-of-the art facilities
- Integral and remote signal converter availability
- Optional grounding rings or grounding electrode
- Measurement largely independent of flow profile
- Low-power digital microcontroller (16 bit)
- Simple programming procedure
- Digital and infrared outputs
- Automatic zero-point stability
- Non-volatile programming
- NSF listed
- Data logging

Badger Meter®

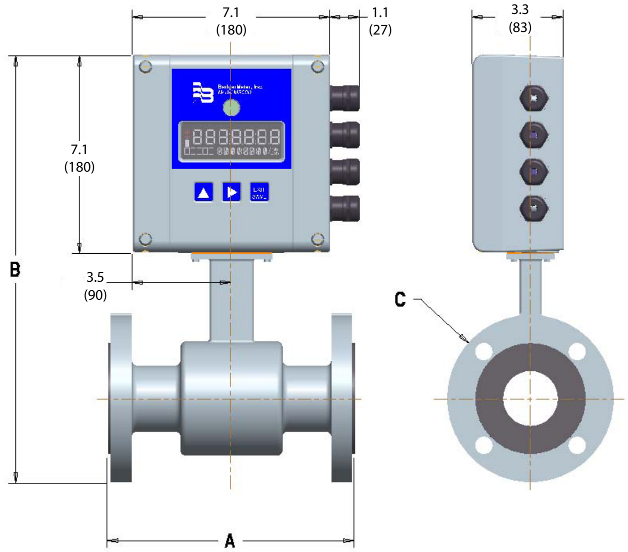
MAG-DS-00175-EN-08 (March 2020)

Product Data Sheet

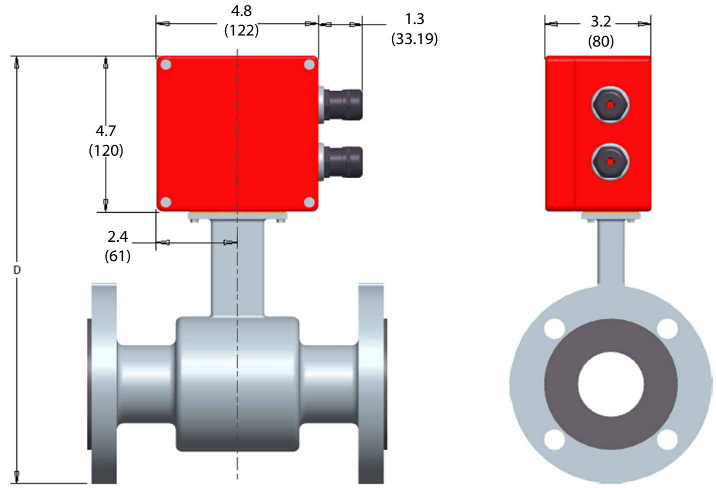
SPECIFICATIONS

Flow Range	0.1…32.8 ft/s (0.03…10 m/s)	
Repeatability	± 0.1%	
Accuracy	± 0.4% of measured value ± 2 mm/s	
Minimum Fluid Conductivity	≥ 20 micro siemens/cm	
Pressure Limits	Maximum allowable non-shock pressure and temperature ratings for steel pipe flanges, according to American National Standard ANSI B16.5. Examples: 150-lb flange, rated 285 psi at ambient temperature; 300-lb flange rated 740 psi at ambient temperature.	
Fluid Temperature	**With Remote Amplifier:** PTFE 302° F (150° C), Hard rubber 178° F (80° C)	**With Meter-Mounted Amplifier:** PTFE 212° F (100° C), Hard rubber 178° F (80° C)
Ambient Temperature	– 4…140° F (–20…60° C)	
Flow Direction	Uni-directional or bi-directional. Two separate programmable totalizers for uni-directional measurement.	
Outputs (4 digital)	Galvanically isolated open collector, 30V DC maximum, 20 mA each, maximum output frequency at 100 Hz	
Outputs	ADE, High/low flow alarm (0…100% of flow), error alarm, empty pipe alarm, flow direction	
Communication	RS232 Modbus RTU, IrDA	
Empty Pipe Detection	Field-tunable for optimum performance based on specific application	
Min-Max Flow Alarm	Programmable outputs 0…100% of flow	
Low Flow Cut-Off	Programmable 0…10% of maximum flow	
Galvanic Separation	Functional 50 volts	
Pulse Width	Programmable 5…500 ms	
Coil Power	Pulsed DC	
Sampling Rate	Programmable from 1 to 63 seconds. Standard sampling period is 15 seconds.	
Display	Two lines x 15 characters (7 on top + 8 on bottom), LCD display	
Programming	Three external buttons	
Units of Measure	Gallons, ounces, MGD, liters, cubic meters, cubic feet, imperial gallon, barrel, hectoliter and acre feet	
Battery Life	10 years	
Power Supply	Internal lithium batteries 3.6 volt	
Processing	Low power microcontroller (16 bit)	
Amplifier Housing	NEMA 4X (IP66), cast aluminum, powder-coated paint	
Meter Housing Material	*Standard*: Carbon steel welded	
Pipe Spool Material	304 stainless steel	
Flanges	*Standard*: ANSI B16.5 Class 150 RF Cast steel; *Optional*: 316 stainless steel & 300 lb cast steel	
Liner Material	PTFE 0.5…24 in. , Hard rubber 1…24 in.	
Electrode Materials	*Standard*: Alloy C; *Optional*: 316 stainless steel	
Mounting	Detector-mount or remote wall mount (bracket supplied)	
Meter Enclosure Classification	NEMA 4X (IP66); *Optional*: Submersible NEMA 6P (IP67) or IP68, remote amplifier required	
Junction Box Enclosure Protection	For remote amplifier option: Powder coated die-cast aluminum, NEMA 4 (IP66)	
NSF Listed	Models with hard rubber liner 4 in. size and up; PTFE liner, all sizes.	
Cable Entries	1/2 in. NPT Cord Grip	
Optional Stainless Steel Grounding Rings	Meter Size — Thickness (of 1 ring) Up through 1 in. — 0.135 in. 12…24 in. — 0.187 in.	

DIMENSIONS IN INCHES (MILLIMETERS)



Meter with M5000 Amplifier

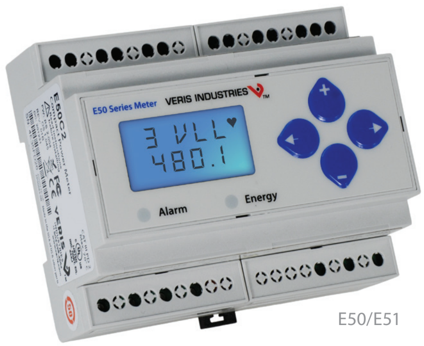


Meter with Junction Box for Remote M5000 Amplifier

Size		A		B		C		D		Est. Weight with Amplifier		Flow Range			
												LPM		GPM	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg	min	max	min	max
1/2	15	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.32	106	0.09	27
3/4	20	6.7	170	13.6	347	3.9	99	14	356	17	7.7	0.57	188	0.15	49
1	25	8.9	225	13.8	352	4.3	108	14.2	361	18	8.8	0.89	294	0.24	77
1-1/4	32	8.9	225	14.6	372	4.6	117	15	381	20.3	9.2	1.45	482	0.39	127
1-1/2	40	8.9	225	14.8	376	5.0	127	15.2	386	22	10	2.27	753	0.60	199
2	50	8.9	225	15.3	389	6.0	152	15.7	398	26	11.7	3.54	1178	0.94	311
2-1/2	65	11.0	280	16.5	420	7.0	178	16.9	429	35	15.7	5.98	1990	1.58	525
3	80	11.0	280	16.7	426	7.5	191	17.2	435	38	17.1	9.05	3015	2.39	796
4	100	11.0	280	17.8	452	9.0	229	18.2	461	49	22.1	14.2	4712	3.74	1244
5	125	15.8	400	19	484	10.0	264	19.4	493	60	27.1	22.1	7363	5.84	1943
6	150	15.8	400	20	510	11.0	279	20.4	519	71	32.1	31.9	10602	8.40	2799
8	200	15.8	400	21.9	558	13.5	343	22.9	583	96	43.1	56.6	18849	15.0	4976
10	250	19.7	500	26.2	677	16.0	406	26.6	676	130	59.1	88.4	29452	23.4	7775
12	300	19.7	500	28.3	720	19.0	483	28.7	729	219	99.3	127.3	42411	33.6	11196
14	350	19.7	500	30.2	768	21.0	533	30.7	779	287	130.2	173.2	57726	45.8	15239
16	400	23.6	590	33.1	842	23.5	597	33.5	851	354	160.9	226.2	75398	59.8	19905
18	450	23.6	590	34.4	876	25.0	635	34.9	885	409	185.3	286.3	95425	75.6	25192
20	500	23.6	590	337.6	955	27.5	699	38	964	502	228.3	353.5	117809	93.4	31101
22	550	23.6	590	39	991	29.5	749	39.4	1000	532	241.3	427.7	142549	112.9	37633
24	600	23.6	590	41.6	1057	32.0	813	42	1066	561	255.3	509.0	169645	134.4	44786

E5X SERIES

Versatile Energy Monitoring Solution



E50/E51

The E5x Series DIN Rail Meter combines exceptional performance and easy installation to deliver a cost-effective solution for power monitoring applications. The E5x can be installed on standard DIN rail or surface mounted as needed. The Modbus, LON, and BACnet output models offer added flexibility for system integration. The data logging capability (E5xC3 and E5xx5) protects data in the event of a communications or power failure elsewhere in the system. Combinations of serial communication, pulse output, and phase alarms are provided to suit a wide variety of applications. Additional pulse inputs on E5xHx and E50Fx provide an easy way to incorporate simple flow sensors to track gas, water, steam, or other energy forms using a BACnet or LON system.

The E51 models add a bi-directional monitoring feature designed expressly for renewable energy applications, allowing measurement of power imported from the utility grid as well as power exported from the renewable energy source (e.g. solar panels). In this way, a facility administrator can track all energy data, ensuring accuracy in billing and crediting. They are also useful for monitoring loads that use regenerative braking.

Revenue grade measurements

Meets ANSI C12.20 Class 0.2 standards

Multiple applications

Real energy output and phase loss alarm output on E50Bx and E5xCx models…one device serves multiple applications

High reliability

ANSI C12.20 0.2% accuracy, IEC 62053-22 Class 0.2S on E5xxx

Data logging

Ensures long term data retrieval and safeguards during power failures (E5xC3 and E5xx5)

Easy installation

DIN rail or screw mounting options

Wide CT compatibility

Compatible with CTs from 5 A to 32000 A

APPLICATIONS

- Energy monitoring in building automation systems
- Renewable energy
- Energy management
- Commercial sub-metering
- Industrial monitoring
- Cost allocation

SPECIFICATIONS

INPUTS	
Control Power, AC	50/60 Hz; 5 VA max.; 90 V min.; UL Maximums: 600 V_{L-L} (347 V_{L-N}); CE Maximum: 300 V_{L-N}
Control Power, DC	3W max.; UL and CE: 125 to 300 Vdc (external DC current limiting required)
Voltage Input	UL: 90 V_{L-N} to 600 V_{L-L}; CE: 90 V_{L-N} to 300 V_{L-N}
CURRENT INPUT	
Scaling	5 A to 32,000 A
Input Range	0 to 0.333 V or 0 to 1 V (selectable) CTs must be rated for use with Class 1 voltage inputs
Pulse Inputs E5xHx & E50Fx only	Contact inputs to pulse accumulators (one set with E5xH2 and E50F2; two sets with E5xH5 and E51F5)*
ACCURACY	
Real Power & Energy	0.2% (ANSI C12.20, IEC 62053-22 Class 0.2S)
OUTPUTS	
E50B1 & E5xCx	Real Energy Pulse: N.O. static**; Alarm contacts: N.C. static**
E50Bx	Reactive energy pulse 30 Vac**
E5xCx	RS-485 2-wire Modbus RTU (1200 baud to 38.4 kbaud)
E5xHx	RS-485 2-wire BACnet MS/TP (9600 baud to 115.2 kbaud)
E50Fx	2-wire LON FT
MECHANICAL	
Mounting	DIN Rail or 3-point screw mount
ENVIRONMENTAL	
Altitude of Operation	3000 m
Operating Temp Range	-30 to 70 °C (-22 to 158 °F)
Storage Temp Range	-40 to 85 °C (-40 to 185 °F)
Humidity Range	<95% RH non-condensing
Mounting Location	Not suitable for wet locations. For indoor use only.
WARRANTY	
Limited Warranty	5 years
AGENCY APPROVALS	
Agency Approvals	UL 508 (Open Type Device), IEC/EN 61010-1, California CSI Solar, ANSI C12.20, Cat III, Pollution Degree 2

E51Cx only

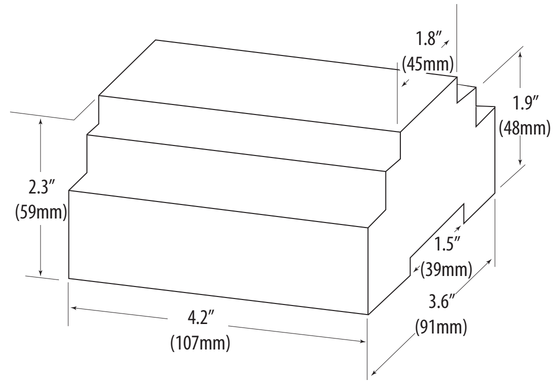
E5xH2 only

*10 kΩ Vac/dc to 4 to 10 Vdc.
**30 Vac/dc, 100 mA max. (AC: 50/60Hz).

ORDERING INFORMATION

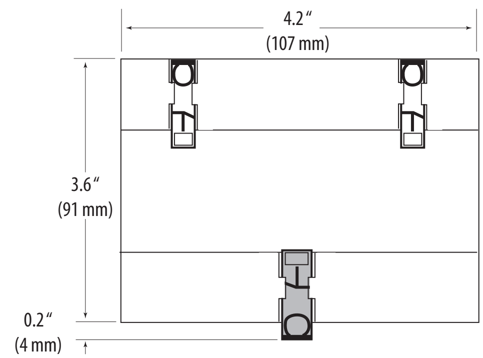
	E50B1	E50C2	E50C3	E50F2	E50F5	E50H2	E50H5	E51C2	E51C3	E51H2	E51H5
MEASUREMENT CAPABILITY - FULL DATA SET											
Bi-directional Energy Measurements									•	•	•
Power (3-phase total and per phase): Real (kW) Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Power Factor: 3-phase average & per phase	•	•	•	•	•	•	•	•	•	•	•
Present Power Demand: Real (kW), Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Import and Export totals of Present Power Demand: Real (kW), Reactive (kVAR), & Apparent (kVA)								•	•	•	•
Peak Power Demand: Real (kW), Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Current (3-phase average and per phase)	•	•	•	•	•	•	•	•	•	•	•
Voltage: Line-Line and Line-Neutral (3-phase average and per phase)	•	•	•	•	•	•	•	•	•	•	•
Frequency	•	•	•	•	•	•	•	•	•	•	•
ANSI C12.20 0.2% accuracy, IEC 62053-22 Class 0.2S	•	•	•	•	•	•	•	•	•	•	•
Accumulated Net Energy: Real (kWh), Reactive (kVARh), and Apparent (kVAh)	•	•	•	•	•	•	•	•	•	•	•
Accumulated Real Energy by phase (kWh)	•	•	•	•	•	•	•	•	•	•	•
Import and Export Accumulators of Real and Apparent Energy								•	•	•	•
Reactive Energy Accumulators by Quadrant (3-phase total & per phase)								•	•	•	•
Demand Interval Configuration: Fixed or Rolling Block	•	•	•	•	•	•	•	•	•	•	•
Demand Interval Configuration: External Sync to Comms		•	•	•	•	•	•	•	•	•	•
DATA LOGGING											
Data Logging: 10 16-Bit Configurable (can include Date/Time) Data Buffers			•						•		
Data Logging: 3 Timestamped 32-Bit Configurable Data Buffers					•		•				•
Store up to 60 days of readings at 15-minute intervals			•		•		•		•		•
OUTPUTS											
Alarm Output (N.C.)	•	•	•	•		•		•	•	•	
1 Pulse Output (N.O.)		•	•					•	•		
2 Pulse Outputs (N.O.)	•										
RS-485 Serial (Modbus RTU Protocol)		•	•					•	•		
RS-485 Serial (BACnet MS/TP Protocol)						•	•			•	•
LON FT Serial (LonTalk Protocol)				•	•						
INPUTS											
2 Pulse Contact Accumulator Inputs					•		•				•
1 Pulse Contact Accumulator Input				•		•				•	

DIMENSIONAL DRAWING



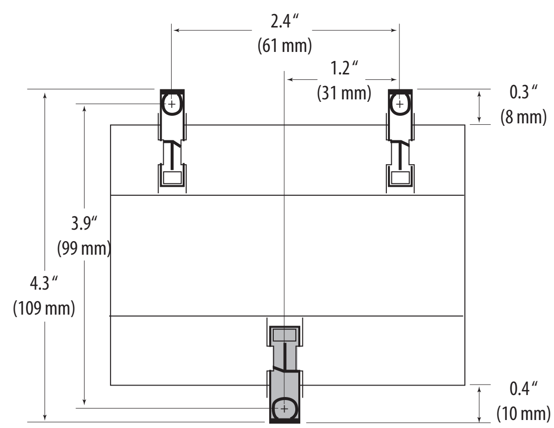
DIN MOUNT CONFIGURATION

Mounting Diagram



SCREW MOUNT CONFIGURATION

Mounting Diagram



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