The Mayfair

301 East 69th Street

New York, NY 10021

As-Built August 2020

Submitted to:

Frontier Energy
2695 Bingley Road
Cazanovia, NY 13035

Submitted by:

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1. Introduction

En-Power Group designed and oversaw the installation of a combined heat and power (CHP) system at the Mayfair. 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+ 100kW engine generator unit. The inverter-based system is intended to produce a gross output of 100 kW and recover engine jacket water and exhaust heat recovery for:

a) Pre-heating the space heating hot water loop which in turn heats:
    i. DHW heating,
    ii. Space Heating

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.**

Data Logger

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.

Onsite Installation

The contractor installed a CHPInsight panel next to the 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.

Communications

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 supplied monitoring equipment, with En-Power taking the responsibility 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	Data 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	Pulse Out	Pulse	Outer wall of CHP room
T_{OUT1}	BTU-S1	Engine Heating Module Supply Temperature	°F	Onicon System-10	ModBus	CHP Room
T_{RET1}	BTU-R1	Engine Heating Module Return Temperature	°F	Onicon System-10	ModBus	CHP Room
F_{NET1}	BTU-1	Engine Heating Module System Flow	GPM	Onicon System-10	ModBus	CHP Room
Q_{NET1}	BTU-1	CHP Engine Heat Supplied	BTUh	Onicon System-10	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

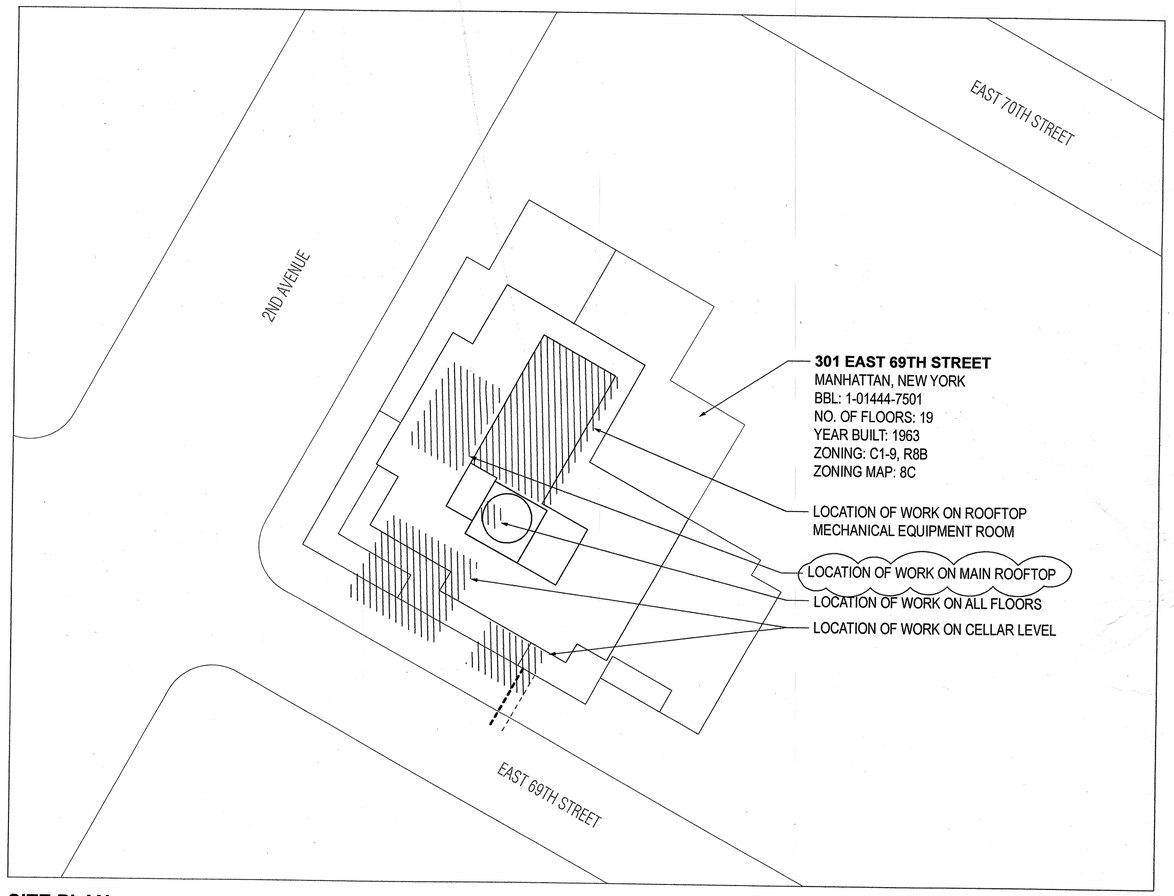
System Schematics

NYC DOB FILING
DISTRICT STEAM TO NATURAL GAS CONVERSION &
COMBINED HEAT AND POWER (CHP) INSTALLATION PLANS

301 EAST 69TH STREET

c/o TIMOTHY FINE
RUDD REALTY MANAGEMENT CORP.

REVISED 01/30/2018:
-Added TR1 Inspection
-Added CHP Unit Comissioning Note
-Updated Drawing Index and
Page Numbers
-Updated Location of Work on Site Plan



SITE PLAN

1/64" = 1'-0"

---------- NEW 8" Ø LP GAS SERVICE
- - - - - - - - - - EXISTING 4" Ø LP GAS SERVICE (TO BE ABANDONED)

REQUIRED SPECIAL AND PROGRESS INSPECTIONS FOR NYC DOB FILINGS
BASED ON THE 2016 TR1: TECHNICAL STATEMENT OF RESPONSIBILITY OF NEW YORK CITY
301 EAST 69TH STREET, NY, NY - STEAM TO GAS CONVERSION - CLIMATE ZONE 4A

INSPECTION / TEST	PERIODIC (MINIMUM)	TYPE	CODE / SECTION
Mechanical Systems	After installation and prior to sign-off	Special	BC 1704.16
Heating Systems	After installation and prior to sign-off	Special	BC 1704.25
Chimneys	After installation and prior to sign-off	Special	BC 1704.26
Fire-Resistant Penetrations and Joints	Prior to completion of all work	Special	BC 1704.27
Energy Code Compliance Inspections	See Progress Inspection Table	Progress	BC 110.3.5
Emergency and Standby Power Systems (Generators)	Prior to completion of all work	Special	BC 1704.31
Final	Prior to completion of all work	Progress	28-116.2.4.2, BC 110.5, DIRECTIVE 14 OF 1975, AND 1 RCNY §101-10

PROGRESS INSPECTIONS FOR ENERGY CODE COMPLIANCE
BASED ON THE 2016 NEW YORK CITY ENERGY CONSERVATION CODE
301 EAST 69TH STREET, NY, NY - STEAM TO GAS CONVERSION - CLIMATE ZONE 4A

INSPECTION / TEST	PERIODIC (MINIMUM)	REFERENCE STANDARD (SEE ECC CHAPTER C5) OR OTHER CRITERIA	ECC OR OTHER CITATION
IIA6: Air sealing and insulation — visual	After installation of pipe sleeve for boiler gas line and swingover gas line.	Approved Construction Documents	C402.5
IIB2: Shutoff dampers	After installation of motorized intake damper.	Approved Construction Documents	C403.2.4.3
IIB3: HVAC and service water heating equipment	Prior to final plumbing and construction inspection.	Approved Construction Documents	C403.2, C404.2, C404.9, C406.2; ASHRAE 90.1 – 6.3, 6.4.1, 6.4.2, 6.8, 7.4, 7.8
IIB4: HVAC and service water heating system controls	After installation and prior to final construction inspection. In seasonally dependent cases, prior to sign-off or issuance of final Certificate of Occupancy.	Approved Construction Documents	C403.2.4, C403.2.6.1, C403.2.13, C406.3, C403.4, C404.6, C404.9; ASHRAE 90.1 – 6.3, 6.4, 6.5, 7.4.4, 7.4.5
IIB5: HVAC insulation and sealing	After installation and prior to closing shafts, ceilings, and walls.	Approved Construction Documents	C403.2.9, C403.2.10, C404.4, MC603.9; ASHRAE 90.1 – 6.3, 6.4.4, 6.8.2, 6.8.3, 7.4.3
IIC7: Electric motors (including but not limited to fan motors)	Prior to final electrical or construction inspection.	Approved Construction Documents	C403.2.12; ASHRAE 90.1 – 10.4
IID1: Maintenance information	Prior to sign-off or issuance of final Certificate of Occupancy	Approved Construction Documents	C303.3, C408.2.5.2; ASHRAE 90.1 – 4.2.2.3, 6.7.2.2, 8.7.2, 9.7.2.2

GENERAL NOTES

1. THE CONTRACTOR SHALL BE FAMILIAR WITH ALL ASPECTS OF THE WORK SCOPE.
2. THE CONTRACTOR SHALL BE FAMILIAR WITH ALL CURRENT APPLICABLE CODES INCLUDING BUT NOT LIMITED TO THE 2014 NEW YORK CITY CONSTRUCTION CODES, 2016 NYC ENERGY CONSERVATION CODE, AND NEW YORK CITY RULES AND REGULATIONS (NYCRR) TITLE 12 PART 4.
3. DRAWINGS ARE INTENDED TO SHOW A GENERAL DESIGN OF PROPOSED SYSTEMS, DEVIATIONS FROM SPECIFIED LAYOUT MUST BE CLEARED WITH THE ENGINEER.
4. SPECIAL INSPECTIONS AND EQUIPMENT USE CARDS MUST BE PERFORMED BY A LICENSED PROFESSIONAL ENGINEER AS NECESSARY.
5. THE WORK PERFORMED IN THE BUILDING SHALL BE DONE WHEN AND AS DIRECTED, AND IN A MANNER SATISFACTORY TO THE OWNER.

NYCECC COMPLIANCE STATEMENT

TO THE BEST OF MY KNOWLEDGE, BELIEF, AND PROFESSIONAL JUDGEMENT, THESE PLANS AND SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2016 NEW YORK CITY ENERGY CONSERVATION CODE BY WAY OF CHAPTER C5 FOR ALTERATIONS TO EXISTING BUILDINGS.

NOTE: OPERATION & MAINTENANCE MANUALS TO BE PROVIDED PRIOR TO FINAL SIGN-OFF FOR NEW GAS-FIRED HOT WATER BOILERS AND DIRECT-FIRED DOUBLE ABSORPTION CHILLER. STAND ALONE START-UP PROCEDURE MANUAL TO BE PROVIDED FOR ALL NEW EQUIPMENT AT SAME TIME.

HOT WATER BOILER [HB-1 THRU HB-4] COMMISSIONING NOTE: NEW HOT WATER BOILERS REQUIRE COMMISSIONING FOR THE INSTALLATION OF FOUR (4) 2,500 MBH HOT WATER BOILERS BY A CERTIFIED BUILDING COMMISSIONING PROFESSIONAL (CBCP).

DIRECT-FIRED DOUBLE ABSORPTION CHILLER [CH-1] COMMISSIONING NOTE: NEW DIRECT-FIRED DOUBLE ABSORPTION CHILLER REQUIRES COMMISSIONING FOR THE INSTALLATION OF ONE (1) 250 TON DIRECT-FIRED DOUBLE ABSORPTION CHILLER BY A CERTIFIED BUILDING COMMISSIONING PROFESSIONAL (CBCP).

CHP UNIT [CHP-1] COMMISSIONING NOTE: NEW CHP UNIT REQUIRES COMMISSIONING FOR THE INSTALLATION OF ONE (1) 1,152 CFH COMBINED HEAT AND POWER UNIT BY A CERTIFIED BUILDING COMMISSIONING PROFESSIONAL (CBCP).

DEPT BLDGS Job No. 140714902
Scan Code ESHS0466378

FOR OFFICIAL USE ONLY:

AMENDED PLAN

Accepted for OPPN #1/04
Professional Certification
MANHATTAN
Date: OCT 0 5 2018

DRAWING INDEX

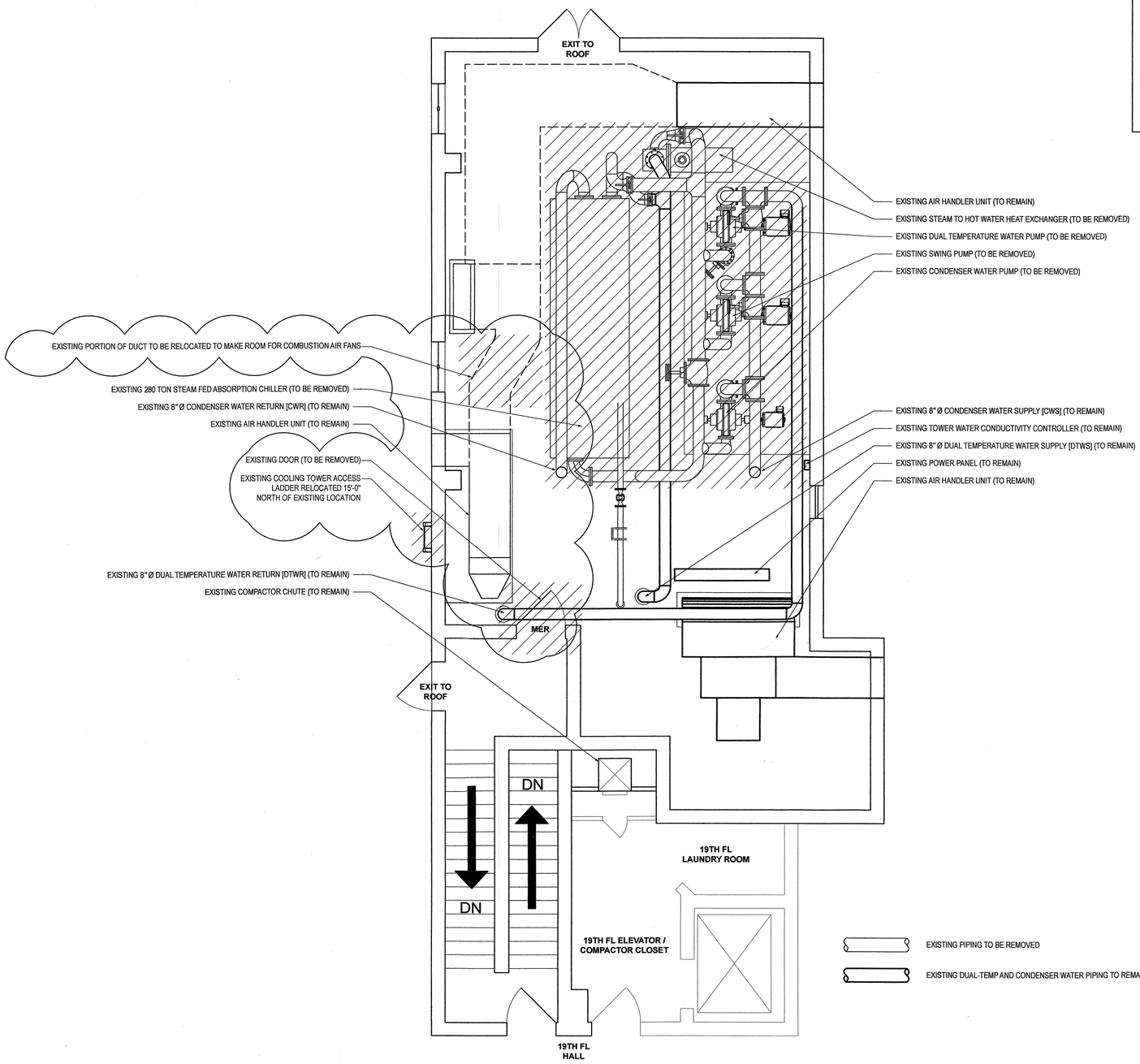
EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT
301 EAST 69TH ST.
STEAM TO GAS CONVERSIO
&
CHP INSTALLATION

P.E. STAMP
STATE OF NEW YORK
MICHAEL VINCENT SCORRANO
077136-1
LICENSED PROFESSIONAL ENGINEER

ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	SITE PLAN
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: T.G.B.	DATE: 11/03/2017
PAGE: 1 of 12	SHEET: T-100.01

REVISED 01/30/2018:
-Updated Drawing Index and Page Numbers
-Added existing ductwork to plan
-Added to demolition: a portion of existing duct, existing MER door, and existing cooling tower access ladder.



ROOF LEVEL MECHANICAL EQUIPMENT ROOM (MER)
DEMOLITION PLAN 3/16" = 1'- 0"

DRAWING INDEX

PAGE	SHEET	DESCRIPTION
1 of 12	T-100.01	SITE PLAN
2 of 12	M-100	GENERAL NOTES & DETAILS
3 of 12	M-101	CODE NOTES
4 of 12	M-102.01	ROOF LEVEL DEMOLITION PLAN
5 of 12	M-103.01	PROPOSED PLANS
6 of 12	M-104.01	ROOF LEVEL PROPOSED PLANS (1)
7 of 12	M-105	ROOF LEVEL PROPOSED PLANS (2)
8 of 12	M-106	SCHEDULES
9 of 12	P-100.01	PLUMBING DIAGRAM
10 of 12	EN-100	ENERGY ANALYSIS
11 of 12	S-100	EQUIPMENT FRAMING DETAILS(1)
12 of 12	S-101	EQUIPMENT FRAMING DETAILS(2)

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT
301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

P.E. STAMP
STATE OF NEW YORK MICHAEL VINCENT SCORRANO 077136-1 LICENSED PROFESSIONAL ENGINEER

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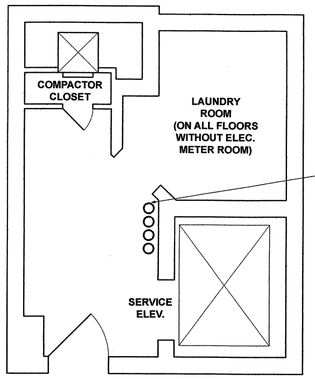
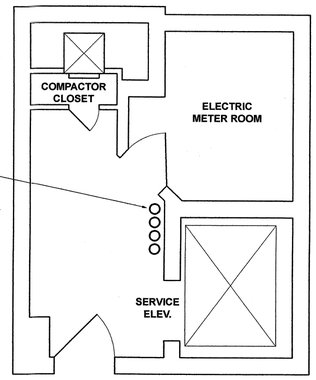
AMENDED PLAN
Accepted for OPPN #1/04
Professional Certification
MANHATTAN
Date: OCT 05 2018

DEPT BLDGS Job No. 140714902
Scan Code ESHS2969852

ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	ROOF LEVEL DEMO PLAN
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: T.G.B.	DATE: 11/03/2017
PAGE: 4 of 12	SHEET: M-102.01

REVISED 01/30/2018:
-Updated Drawing Index and Page Numbers
-Updated Gas Riser Diagram
-Updated Gas Piping to Reflect As-Built Conditions
-Added LP description to the legend

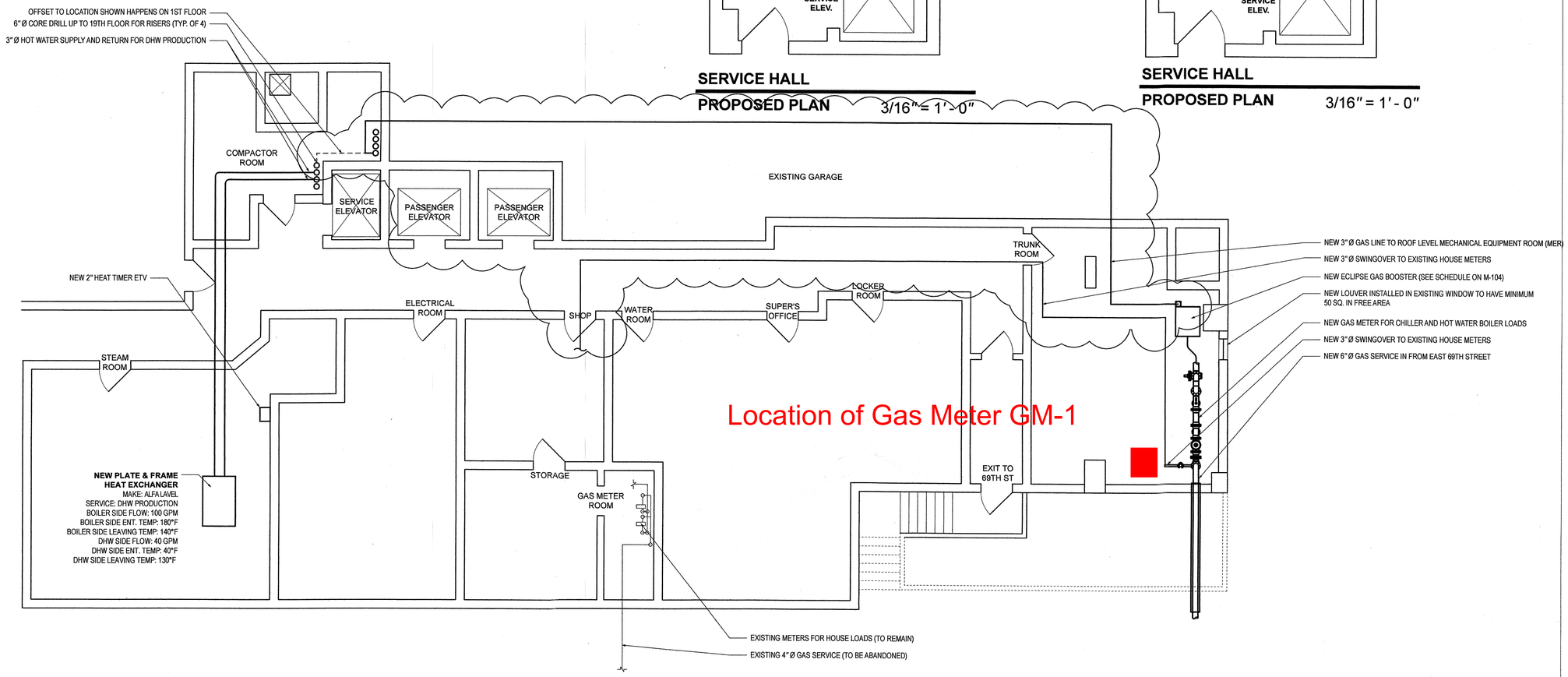




6" Ø CORE DRILL UP TO 19TH FLOOR FOR RISERS (TYP. OF 4)

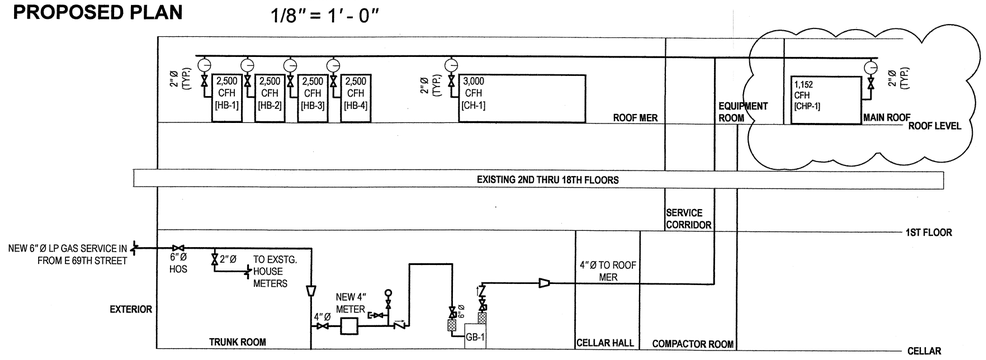
SERVICE HALL
PROPOSED PLAN 3/16" = 1'-0"

SERVICE HALL
PROPOSED PLAN 3/16" = 1'-0"



Location of Gas Meter GM-1

PARTIAL CELLAR
PROPOSED PLAN 1/8" = 1'-0"



GAS RISER DIAGRAM
NTS

- TYPICAL PLUG SHUT OFF VALVE (SOV)
- TYPICAL BUTTERFLY SHUT OFF VALVE (SOV)
- CON EDISON APPROVED CHECK VALVE
- CON EDISON APPROVED LOW GAS PRESSURE SWITCH
- CON EDISON APPROVED LOW GAS PRESSURE SWITCH
- FLEXIBLE CONNECTOR
- 1/2" Ø MANOMETER TEST PORT
- REDUCER

HOS = HEAD OF SERVICE
LP = LOW PRESSURE

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Scan Code ESHS6322354

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Date: OCT 05 2018

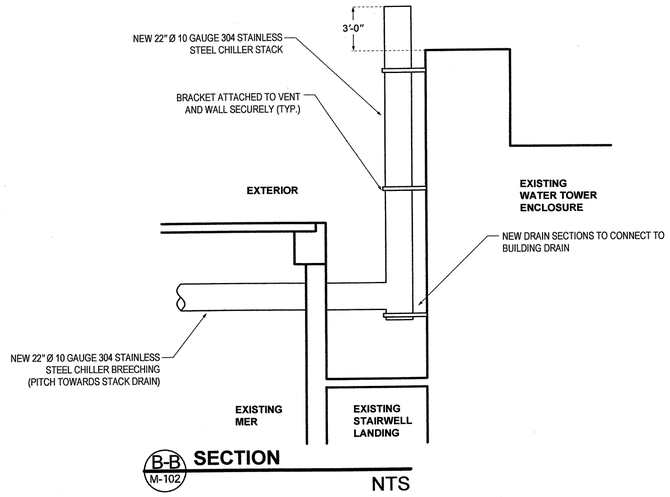
DRAWING INDEX

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT
301 EAST 69TH ST.
STEAM TO GAS CONVERSIO
&
CHP INSTALLATION

P.E. STAMP
STATE OF NEW YORK * MICHAEL VINCENT SCORRANO * 077136-1 LICENSED PROFESSIONAL ENGINEER

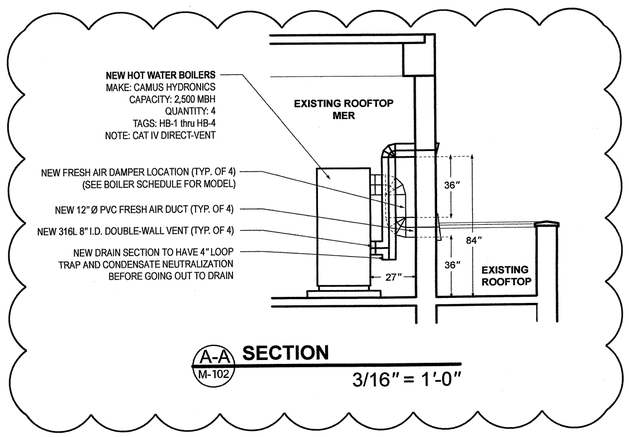
ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	PROPOSED PLANS
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: T.G.B.	DATE: 11/03/20
PAGE: 5 of 12	SHEET: M-103.0



B-B M-102 **SECTION**

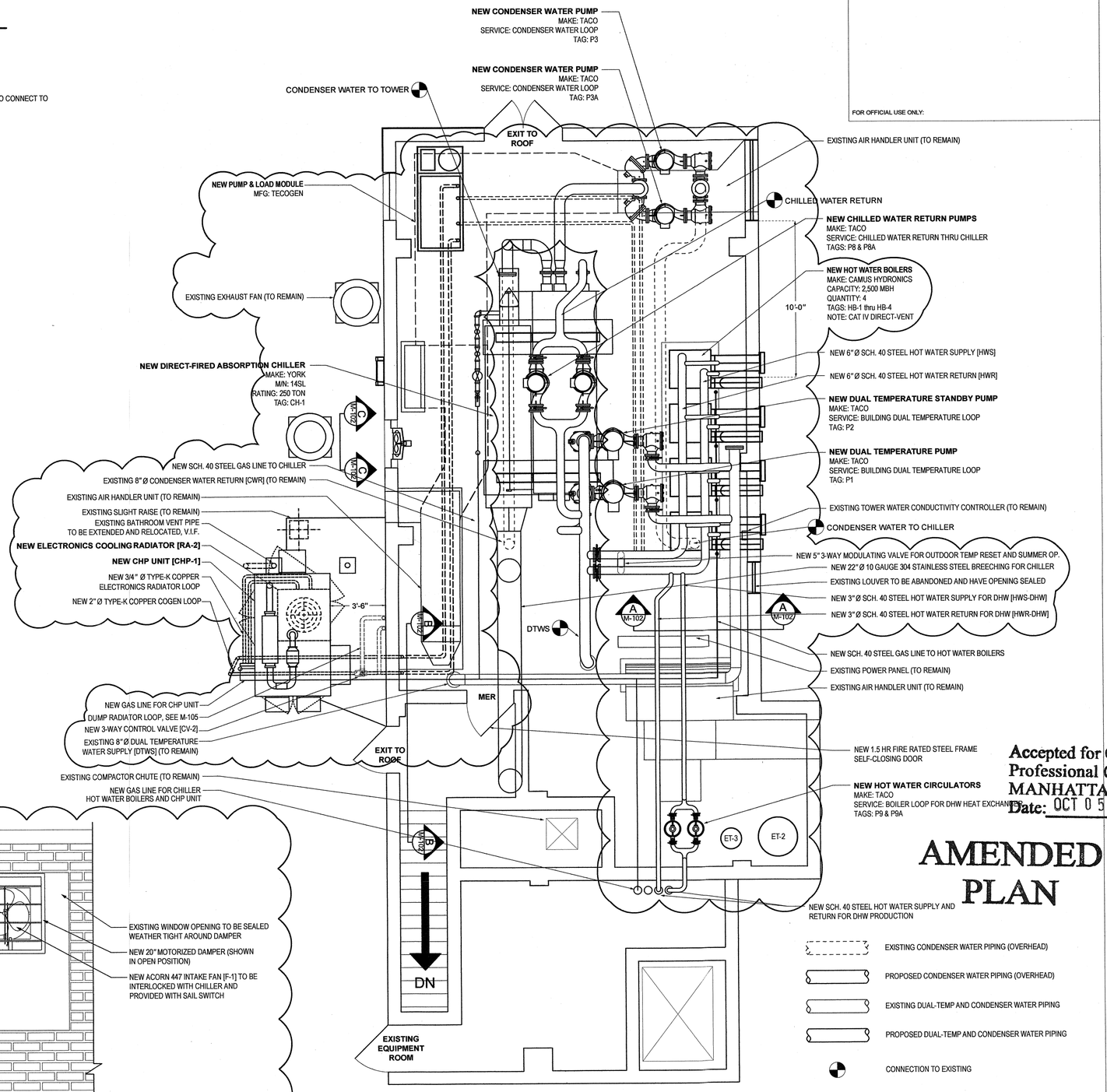
NTS

TERMINATION NOTE: PROPOSED VENTS TO TERMINATE 3 FEET ABOVE ALL CONSTRUCTION WITHIN 10 FEET, AND BE AS TALL AS ALL CONSTRUCTION (EXCLUDING OPEN STRUCTURAL FRAMES OR OTHER CHIMNEYS) WITHIN 15 FEET.



A-A M-102 **SECTION**

3/16" = 1'-0"



ROOF LEVEL MECHANICAL EQUIPMENT ROOM (MER)

PROPOSED PLAN 3/16" = 1'-0"

REVISED 04/11/2018:
- Added cogen and associated equipment.
- Moved schedules to M-106.
- Added existing roof equipment.
- Updated Drawing Index and page numbers .
- Updated location of combustion air fan FA-1.
- Added new door.
- Shifted location of existing duct.
- Updated location of cooling tower access ladder.
- Added expansion tanks ET-2 and ET-3.
- Updated material of proposed boiler breeching and updated venting method to Direct-Vent per Commissioner approval obtained during 2/15/18 meeting.
- New motorized fresh air damper added to intake of proposed boilers for Direct-Vent method.
- Removed combustion air fan that served proposed boilers.
- Added pump P3A for condenser water flow parallel operation.
- Updated plan to show chilled water pumps P8 and P8A and hot water circulation pumps P9 and P9A.
- Added 3-way modulating valve for outdoor temperature reset and summer bypass operation.

ELEVATION C-C

PROPOSED 1/2" = 1'-0"

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Professional Certi:
MANHATTAN
Date: OCT 05 2018

AMENDED PLAN

DEPT BLDGS Job No. 140714902
Scan Code ESHS1531557

DRAWING INDEX

EN-POWER GROUP

50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT

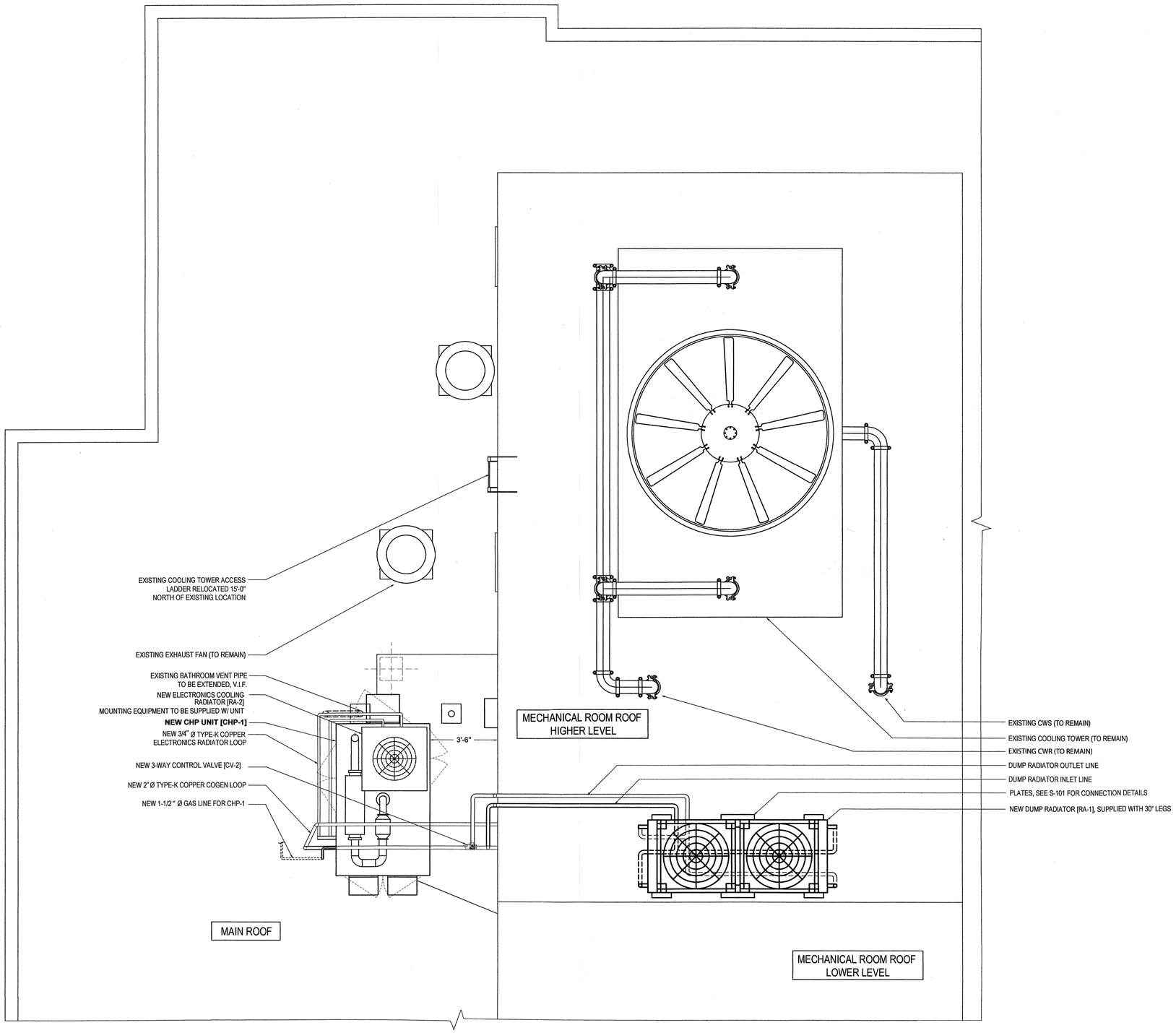
301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

P.E. STAMP

STATE OF NEW YORK
MICHAEL VINCENT SCORRANO
077136-1
LICENSED PROFESSIONAL ENGINEER

ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	MER PROPOSED PLANS
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: T.G.B.	DATE: 11/03/17
PAGE: 6 of 12	SHEET: M-104.01

ADDED TO SET 11/28/2017



PARTIAL ROOF PLAN

1/4" = 1'- 0"

DRAWING INDEX

EN-POWER GROUP

50 MAIN STREET, SUITE 1000
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914.263.1199

PROJECT

301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

P.E. STAMP

STATE OF NEW YORK * MICHAEL VINCENT SCORRANO * 077136-1 * LICENSED PROFESSIONAL ENGINEER

FOR OFFICIAL USE ONLY:

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Professional Certification
MANHATTAN
Date: OCT 0 5 2018

FOR C

DEPT BLDGS Job No. 140714902
Scan Code ESHS1086920

ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	ROOF LEVEL PROPOSED PLN
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: L.N.	DATE: 11/28/2017
PAGE: 7 of 12	SHEET: M-10[illegible]

COGENERATION UNIT SCHEDULE

TAG	LOCATION	GAS DATA			HEAT RECOVERY DATA						ELECTRIC OUTPUT DATA		EXHAUST OUTLET	GENERATOR COOLING CONN.	WEIGHT (lbs)	MAKE / MODEL	NOTES
		INPUT (SCFH)	OPERATING PRESSURE ("w.c.)	CONNECTION	FLUID	FLOWRATE (gpm)	MAX. EWT (°F)	MAX. LWT (°F)	HEAT OUTPUT (Btu/h)	CONNECTION	ELECTRIC CAPACITY	ELECTRIC CHARACTERISTICS					
CHP-1	ROOF	1152	4 - 12	1-1/2" FPT	40% PG	30	230	180	613,000	1-1/2" FPT	100 kW	480V / 3 Φ / 60 Hz	4"	3/4"	4,800	Tecogen / Inverde e+ Ultera Outdoor	UL 1741 and UL 2200 Certified

PUMP SCHEDULE

TAG	QTY	LOCATION	SERVICE	FLUID	FLOWRATE (gpm)	HEAD (ft H_2O)	MOTOR POWER (hp)	CONNECTION	VOLTAGE (V)	PHASE	IMPELLER DIA. (in)	MAKE	MODEL	NOTES
P1 & P2	2	EXISTING ROOFTOP MER	DT Loop	Non Potable Water	840	110	40	6 x 6	200	3	11.2	Taco	KV6011	VFD, P2 is backup to P1
P3 & P3A	2	EXISTING ROOFTOP MER	Condenser	Non Potable Water	560	60	20	6 x 6	200	3	9.0	Taco	KV6009	VFD, & parallel operation
P4 thru P7	4	EXISTING ROOFTOP MER	HWR Pump	Non Potable Water	160	22.60	-	-	-	-	-	-	-	Supplied with HB-1, HB-2, HB-3, and HB-4
P8 & P8A	2	EXISTING ROOFTOP MER	CHW Pump	Non Potable Water	600	33.59	7.5	6 x 6	200	3	10.3	Taco	KV6011	Pumps to alternate
P9 & P9A	2	EXISTING ROOFTOP MER	HX-1 Pump	Non Potable Water	100	45.98	3	2 x 2	200	3	7.0	Taco	1641	Pumps to alternate
P10	1	ROOF	Cogen & Dump Loop	40% PG	30	10.8	-	-	-	-	-	-	-	Supplied by Tecogen
P11	1	EXISTING ROOFTOP MER	Hot Water Loop	Non Potable Water	60	9	0.5	2 x 2	208	3	2	Taco	1635	Supplied by Tecogen
P12	1	EXISTING ROOFTOP MER	Make-Up Water	Non Potable Water	12.5	20	0.33	1½" x 1½"	200	3	4.5	Taco	1611	

REVISED 04/11/2018:
- Sheet added to set.
- Added Cogeneration Unit Schedule to sheet .
- Added CHP Heat Exchanger Schedule to sheet.
- Added Expansion Tank Schedule to sheet.
- Added DHW Plate and Frame Heat Exchanger schedule to sheet.
- Added Radiator Schedule to sheet.
- Added Automatic Feed Tank Schedule to sheet.
- Added Control Valve Schedule to sheet.
- Removed 'Direct-Fired Water Heater /' from title of Heating Boiler Schedule and added Direct-Vent notes.
- Added CHP-1 to service of Gas Booster Schedule.
- Removed intake fan for heating boilers from Intake Fan Schedule.
- Added additional pump data to Pump Schedule for pumps P1, P2, P3, P4 thru P7, P8 & P8A, P9 & P9A. Added pumps P10, P11, and P12 for operation with new CHP unit.
- Added pump P3A for condenser water flow parallel operation.

CHP HEAT EXCHANGER SCHEDULE

TAG	LOCATION	SERVICE	TYPE	CONNECTION (Shell / Tube)	HOT SIDE (COGEN LOOP)					COLD SIDE (LOADS)					MAKE	MODEL	NOTES
					FLUID	FLOWRATE (gpm)	TEMP. IN (°F)	TEMP. OUT (°F)	ΔP (psi)	FLUID	FLOWRATE (gpm)	TEMP. IN (°F)	TEMP. OUT (°F)	ΔP (psi)			
HX-2	EXISTING ROOFTOP MER	Hot Water Loop	Brazed Plate	3" NPT / 2" NPT	40% PG	30	220	170	-	Non-Potable Water	60	140	160	-	-	-	Supplied by Tecogen

EXPANSION TANK SCHEDULE

TAG	LOCATION	SERVICE	FLUID	TANK VOLUME (gal.)	ACCEPTANCE VOLUME (gal.)	SYSTEM CONN. (psi)	WORKING PRESS. (psi)	MAX. TEMP. (°F)	SHIPPING WEIGHT (lbs)	MAKE / MODEL	NOTES
ET-1	EXISTING ROOFTOP MER	Cogen & Radiator Loops	40% PG	33.6	11.3	1/2" NPT	15	240	96	Amtrol / AX-60V	Supplied by Tecogen
ET-2	EXISTING ROOFTOP MER	DT Loop	Non Potable Water	158	158	1-1/2" NPT	40	190	439	Amtrol / 600-L-125	To be used during cooling and heating.
ET-3	EXISTING ROOFTOP MER	Hot Water Loop	Non Potable Water	21.7	11.3	1/2" NPT	40	190	74	Amtrol / AX-40V-125	To be used during cooling only.

DHW PLATE AND FRAME HEAT EXCHANGER

TAG	LOCATION	SERVICE	BOILER SIDE FLOW (GPM)	BOILER SIDE ENT. TEMP. (°F)	BOILER SIDE LEAVING TEMP. (°F)	DHW SIDE FLOW (GPM)	DHW SIDE ENT. TEMP. (°F)	BOILER SIDE LEAVING TEMP. (°F)	MAKE
HX-1	EXISTING CELLAR STEAM ROOM	DHW PRODUCTION	100	180	140	40	40	130	ALFA LAVEL

RADIATOR SCHEDULE

TAG	Qty	LOCATION	SERVICE	LIQUID SIDE						AIR SIDE			ELECTRICAL DATA				SHIPPING WEIGHT (lbs)	MAKE	MODEL
				FLUID	FLOWRATE (gpm)	TEMP. IN (°F)	TEMP. OUT (°F)	ΔP (psi)	CONNECTION	FLUID	FLOWRATE (cfm)	AMBIENT TEMP. (°F)	NO. OF MOTORS / POWER (hp)	VOLTAGE (V)	PHASE	FREQ. (Hz)			
RA-1	2*	ROOF	Dump Loop	40% PG	30 (Total)	220	164.2	1.3	2" Male NPT	AIR	9,000 (Total)	95	2 / 2 (Total:4)	208	3	60	600	Rocore	RH015-2C-8P
RA-2	1	ROOF	Elec. Cooling Loop	40% PG	8	120	100	0.3	#20 SAE 1 5/8-12 UN-2B	AIR	3,990	100	1 / 0.75	208	3	60	205	AKG	AL55

*Two (2) model RH015 are required, plumbed in parallel. Each unit has a single motor/fan combination.

AUTOMATIC FEED TANK SCHEDULE

TAG	LOCATION	SERVICE	FLUID	TANK VOLUME (gal.)	ELECTRIC SUPPLY	MAKE	MODEL	NOTES
AT-1	EXISTING ROOFTOP MER	Cogen & Radiator Loops	40% PG	17	120 V / 1 Phase	Wingert	CGL17	Supplied by Tecogen

GAS BOOSTER SCHEDULE

TAG	QTY.	LOCATION	SERVICE	GAS DATA				MOTOR DATA					SHIPPING WEIGHT (lbs)	MAKE / MODEL
				DESIGN FLOWRATE (scfh)	INLET PRESSURE (" w.c.)	BOOST PRESSURE (" w.c.)	INLET / OUTLET	VOLTAGE (VAC)	PHASE	FREQUENCY (Hz)	MAX CURRENT (Amperes)	PART NO.		
GB-1	1	Cellar Meter Room	HB-1 thru 4, CH-1, & CHP-1	11,600	4	21.6	6" / 4" ANSI Flange	208	3	60	7.8	10002182	491	Eclipse / HB-4623-3

CONTROL VALVE SCHEDULE

TAG	LOCATION	SERVICE	FLUID	TYPE	CONNECTION	ELECTRIC SUPPLY	MAKE	MODEL	NOTES
CV-1	EXISTING ROOFTOP MER	HX-2 Bypass	40% PG	3-Way Mixing	2" FPT	120 V / 1 Phase	Belimo	B352 + ARB120-3	Supplied by Tecogen
CV-2	ROOF	RA-1 Bypass	40% PG	3-Way Mixing	2" FPT	120 V / 1 Phase	Belimo	B352 + ARB120-3	Supplied by Tecogen

INTAKE FAN SCHEDULE

TAG	QTY.	LOCATION	SERVICE	DESIGN FLOWRATE (cfm)	FAN SPEED (rpm)	MOTOR POWER (hp)	MAKE / MODEL
F-1	1	EXISTING ROOFTOP MER	CH-1	1,350	1,140	1/20	Acorn Cat No. 447

DIRECT-FIRED HYDRONIC HEATING BOILER SCHEDULE

TAG	QTY.	LOCATION	SERVICE	GAS DATA			THERMAL OUTPUT DATA					VENT CONNECTION / CATEGORY	SHIPPING WEIGHT (lbs)	MAKE / MODEL	NOTES
				INPUT (scfh)	OPERATING PRESSURE RANGE (" w.c.)	CONNECTION	FLUID	MAX FLOWRATE (gpm)	Δ T (°F) / Δ P (ft)	HEAT OUTPUT (Btu/h)	CONNECTION				
HB-1 thru 4	4	EXISTING ROOFTOP MER	HEATING / DHW	2500	4.5 - 11	1-1/2" NPT	Non Potable Water	160	20 / 8.4	2,200,000	3" Groove Lock	8" / CAT IV	1025	Camus / Dynaflame DFNH 2501 SS	Lead-lag boiler operation. To have ASME 'H' stamp. Units to be near-condensing and be direct-vented. Units to be provided with two gas train electric heaters (Part#: 945-00397-000). Units to be provided with motorized fresh air damper (Model: ADC12 24W/ES - FM).

DIRECT-FIRED ABSORPTION CHILLER SCHEDULE

LOCATION	TAG	QUANTITY	COOLING CAPACITY (Tons)	COP	EVAPORATOR DATA (TOTAL CAPACITY)					ABS. / CONDENSER DATA (TOTAL CAPACITY)					FUEL DATA		NOTES
					FLOW (gpm)	INLET TEMP. (°F)	OUTLET TEMP. (°F)	FOULING FACTOR (ft²hr°F / BTU)	PRESS. DROP (ft. h20)	FLOW (gpm)	INLET TEMP. (°F)	OUTLET TEMP. (°F)	FOULING FACTOR (ft²hr°F / BTU)	PRESS. DROP (ft. h20)	FLOW (cfh)	INLET TEMP. (°F)	
EXISTING ROOFTOP MER	CH-1	1	250	1.02	598.9	54	44	0.00010	26.6	1117.4	85	95	0.00025	16.4	3000	85	DESIGN CAPACITY EXCEEDS 300,000 BTU/hr, REQUIRES AUTOMATIC CONTROL DEVICE.

DRAWING INDEX

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT

301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

P.E. STAMP

STATE OF NEW YORK * MICHAEL VINCENT SCORRANO * 077136-1 LICENSED PROFESSIONAL ENGINEER

FOR OFFICIAL USE ONLY:

AMENDED PLAN

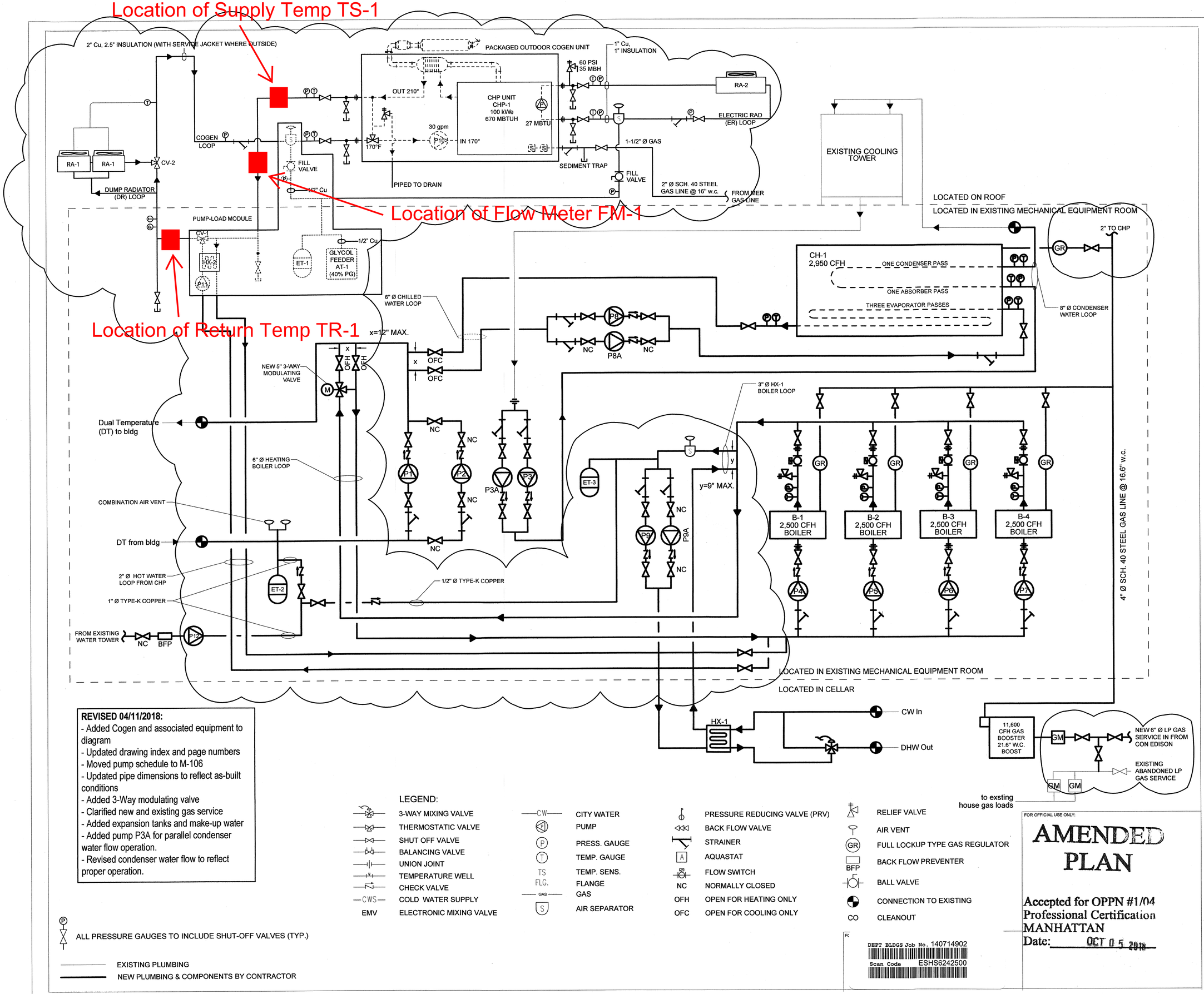
Accepted for OPPN #1/04
Professional Certification
MANHATTAN
Date: OCT 05 2018

ENGINEER: MICHAEL SCORRANO
DESCRIPTION: SCHEDULES
PROJECT ADDRESS: 301 EAST 69TH STREET
DRAWN BY: T.G.B.
DATE: 11/28/2017
PAGE: 8 of 12
SHEET: M-106

Location of Supply Temp TS-1

Location of Flow Meter FM-1

Location of Return Temp TR-1



REVISED 04/11/2018:
- Added Cogen and associated equipment to diagram
- Updated drawing index and page numbers
- Moved pump schedule to M-106
- Updated pipe dimensions to reflect as-built conditions
- Added 3-Way modulating valve
- Clarified new and existing gas service
- Added expansion tanks and make-up water
- Added pump P3A for parallel condenser water flow operation.
- Revised condenser water flow to reflect proper operation.

LEGEND:

	3-WAY MIXING VALVE	CW	CITY WATER		PRESSURE REDUCING VALVE (PRV)
	THERMOSTATIC VALVE		PUMP		BACK FLOW VALVE
	SHUT OFF VALVE	P	PRESS. GAUGE		STRAINER
	BALANCING VALVE	T	TEMP. GAUGE	A	AQUASTAT
	UNION JOINT	TS	TEMP. SENS.		FLOW SWITCH
	TEMPERATURE WELL	FLG.	FLANGE	NC	NORMALLY CLOSED
	CHECK VALVE	GAS	GAS	OFH	OPEN FOR HEATING ONLY
CWS	COLD WATER SUPPLY	S	AIR SEPARATOR	OFC	OPEN FOR COOLING ONLY
EMV	ELECTRONIC MIXING VALVE				

	RELIEF VALVE	GR	FULL LOCKUP TYPE GAS REGULATOR
	AIR VENT	BFP	BACK FLOW PREVENTER
	BALL VALVE		
	CONNECTION TO EXISTING	CO	CLEANOUT

P ALL PRESSURE GAUGES TO INCLUDE SHUT-OFF VALVES (TYP.)

EXISTING PLUMBING

NEW PLUMBING & COMPONENTS BY CONTRACTOR

DEPT BLDGS Job No. 140714902
Scan Code ESHS6242500

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Professional Certification
MANHATTAN
Date: OCT 05 2018

DRAWING INDEX

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT

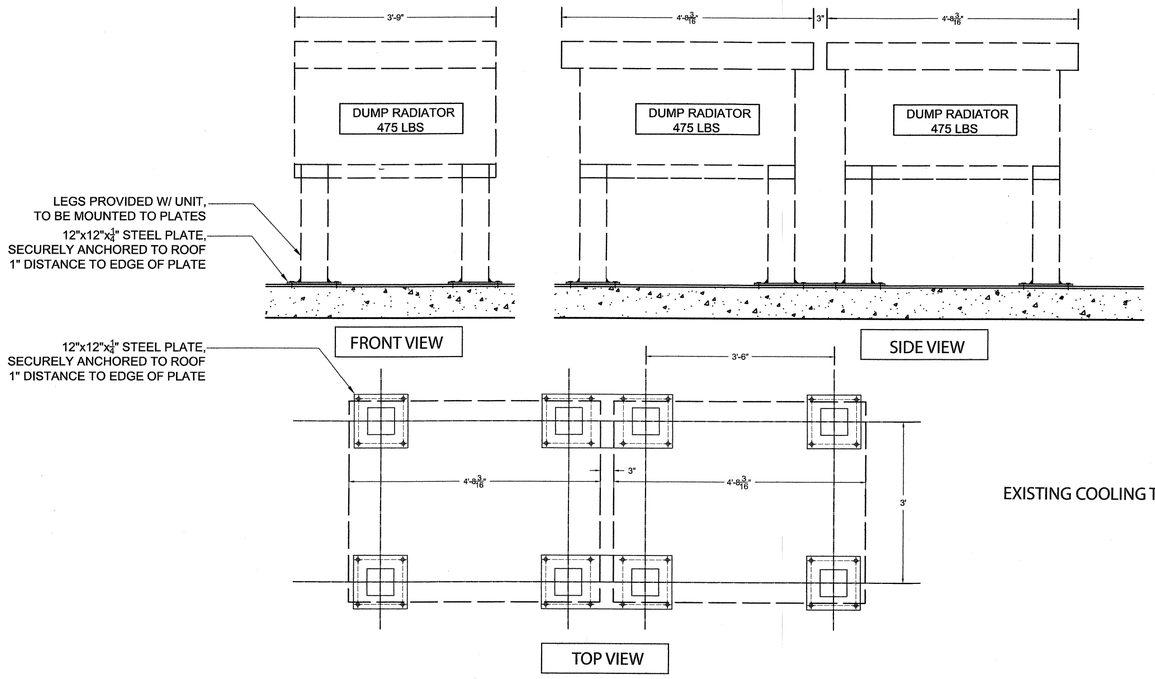
301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

P.E. STAMP

STATE OF NEW YORK VINCENT SCORRANO 077136-1 LICENSED PROFESSIONAL ENGINEER

ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	PLUMBING DIAGRAM
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: T.G.B.	DATE: 11/03/2017
PAGE: 9 of 12	SHEET: P-100.01

ADDED TO SET 11/28/2017



NOTE: PLATES SHALL BE FLASHED TO THE ROOF.

DUMP RADIATOR UNIT

PLATE CONNECTION DETAILS 1/2" = 1' - 0"

MER ROOF PLAN

1/4" = 1' - 0"

FOR OFFICIAL USE ONLY:

AMENDED PLAN

Accepted for OPPN #1/04
Professional Certification
MANHATTAN
Date: OCT 05 2018

FOR OFFICIAL USE ONLY

DEPT BLDGS Job No. 140714902
Scan Code ESHS1643990

DRAWING INDEX

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

PROJECT

301 EAST 69TH ST.
STEAM TO GAS CONVERSION
&
CHP INSTALLATION

Silman		Submission #
		1
Project #	Date returned	Reviewed by
18025	01/03/2017	AE

This document has been reviewed only for:

Design criteria	
Loads imparted	X
Structural configuration	X

Existing structure is adequate to support the loads imposed.

P.E. STAMP

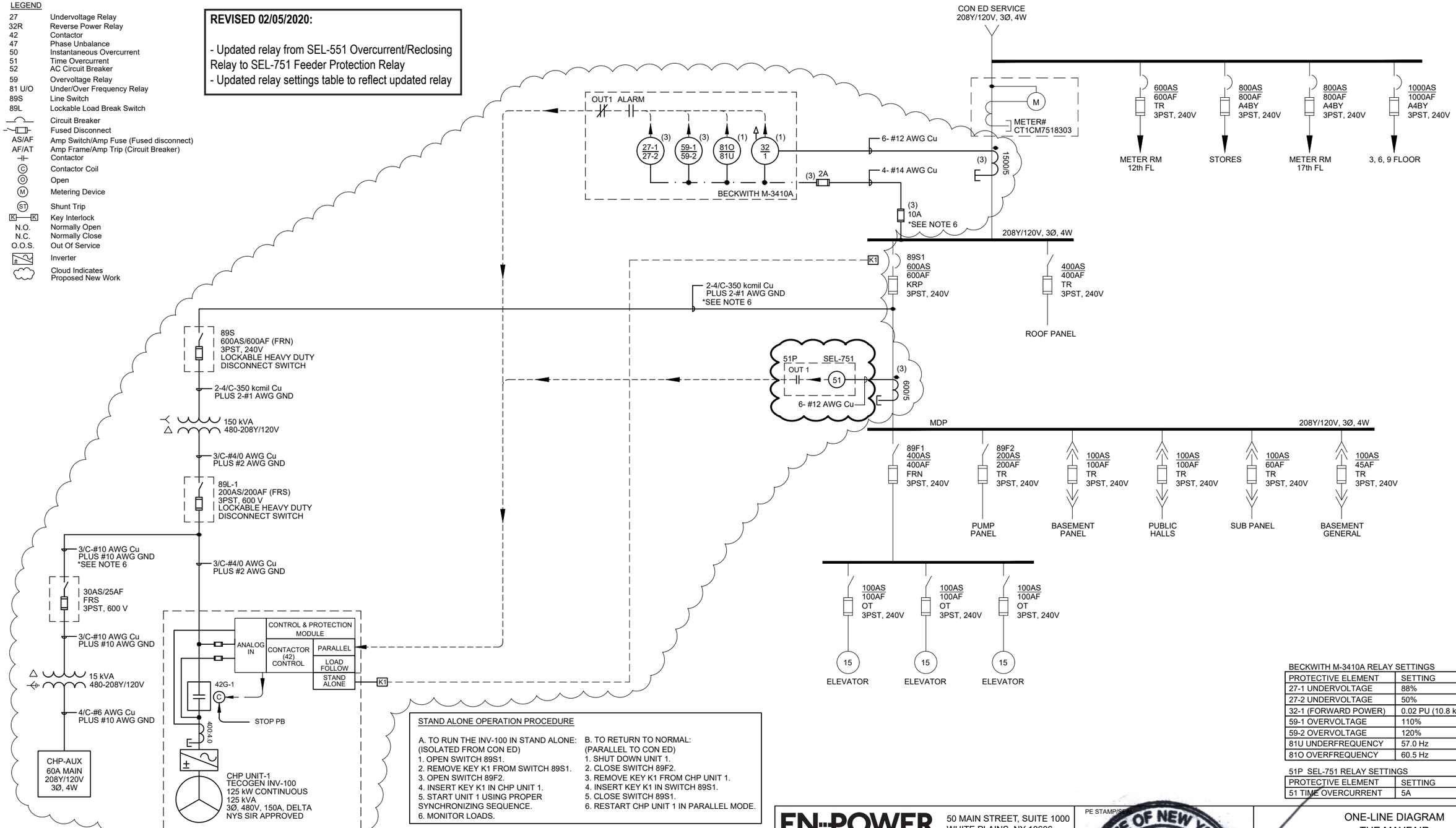
ENGINEER:	MICHAEL SCORRANO
DESCRIPTION:	EQUIPMENT FRAMING DETAILS
PROJECT ADDRESS:	301 EAST 69TH STREET
DRAWN BY: L.N.	DATE: 11/28/2017
PAGE: 12 of 12	SHEET: S-101

LEGEND

27	Undervoltage Relay
32R	Reverse Power Relay
42	Contactor
47	Phase Unbalance
50	Instantaneous Overcurrent
51	Time Overcurrent
52	AC Circuit Breaker
59	Overvoltage Relay
81 U/O	Under/Over Frequency Relay
89S	Line Switch
89L	Lockable Load Break Switch
	Circuit Breaker
	Fused Disconnect
AS/AF	Amp Switch/Amp Fuse (Fused disconnect)
AF/AT	Amp Frame/Amp Trip (Circuit Breaker)
	Contactor
C	Contactor Coil
O	Open
M	Metering Device
ST	Shunt Trip
K — K	Key Interlock
N.O.	Normally Open
N.C.	Normally Close
O.O.S.	Out Of Service
	Inverter
	Cloud Indicates Proposed New Work

REVISED 02/05/2020:

- Updated relay from SEL-551 Overcurrent/Reclosing Relay to SEL-751 Feeder Protection Relay
- Updated relay settings table to reflect updated relay



STAND ALONE OPERATION PROCEDURE

A. TO RUN THE INV-100 IN STAND ALONE: (ISOLATED FROM CON ED)
1. OPEN SWITCH 89S1.
2. REMOVE KEY K1 FROM SWITCH 89S1.
3. OPEN SWITCH 89F2.
4. INSERT KEY K1 IN CHP UNIT 1.
5. START UNIT 1 USING PROPER SYNCHRONIZING SEQUENCE.
6. MONITOR LOADS.

B. TO RETURN TO NORMAL: (PARALLEL TO CON ED)
1. SHUT DOWN UNIT 1.
2. CLOSE SWITCH 89F2.
3. REMOVE KEY K1 FROM CHP UNIT 1.
4. INSERT KEY K1 IN SWITCH 89S1.
5. CLOSE SWITCH 89S1.
6. RESTART CHP UNIT 1 IN PARALLEL MODE.

BECKWITH M-3410A RELAY SETTINGS

PROTECTIVE ELEMENT	SETTING	TIME DELAY
27-1 UNDERVOLTAGE	88%	120 CYCLES
27-2 UNDERVOLTAGE	50%	10 CYCLES
32-1 (FORWARD POWER)	0.02 PU (10.8 kW)	120 CYCLES
59-1 OVERVOLTAGE	110%	60 CYCLES
59-2 OVERVOLTAGE	120%	10 CYCLES
81U UNDERFREQUENCY	57.0 Hz	10 CYCLES
81O OVERFREQUENCY	60.5 Hz	10 CYCLES

51P SEL-751 RELAY SETTINGS

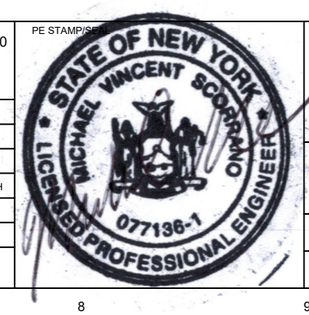
PROTECTIVE ELEMENT	SETTING	TIME DELAY
51 TIME OVERCURRENT	5A	TD= 1 (VI)

NOTES:
1. THIS PROJECT INSTALL ONE NEW 100 kW CHP MODULE AND ALL NECESSARY EQUIPMENT TO PROVIDE PARALLEL OPERATION WITH CON EDISON AND ISOLATED OPERATION IN THE EVENT OF A UTILITY OUTAGE.
2. ALL ELECTRICAL CONSTRUCTION TO BE IN COMPLIANCE WITH 2008 NEC, AS AMENDED BY THE NYC DOB.
3. ALL FUSES INDICATED WILL PROVIDE SELECTIVE COORDINATION, AND HAVE 200 kAIC RATING.
4. THE GENERATOR IS TO BE INSTALLED IN ACCORDANCE WITH NEW YORK STATE STANDARD INTERCONNECTION REQUIREMENTS AND CON ED EO-2115. GENERATORS MAY RUN DURING UTILITY OUTAGE ONLY AFTER SWITCH 89S1 IS IN THE OPEN POSITION, AND KEY IS SET AS REQUIRED.
5. UNLESS NOTED, ALL EQUIPMENT IS EXISTING, AND WILL REMAIN IN USE AND IS PREVIOUSLY APPROVED.
6. CABLE TAPS AND FUSING TO BE IN ACCORDANCE WITH SECTION 240 NFPA 70 (NEC).
7. DISCONNECT SWITCH SHALL BE LOCKABLE WITH VISIBLE BREAK, LABELED AS "89L-1 GENERATOR DISCONNECT SWITCH, MAY BE ENERGIZED FROM EITHER DIRECTION".
8. BOND XO BUSHING TO SERVICE ENTRANCE THROUGH NEUTRAL CONDUCTOR. DO NOT GROUND AT TRANSFORMER.
9. MODIFY ELEVATOR CONTROLS FOR EMERGENCY OPERATION, PROVIDE SELECTIVE COORDINATION PER SECTION 620.62 NFPA 70 (NEC).
10. 51P RELAY TO BE SET TO PREVENT OVERLOAD OF PANEL MDP.

EN-POWER GROUP
50 MAIN STREET, SUITE 1000
WHITE PLAINS, NY 10606
914.263.1199

Rev No.	Date:	Description	By:
2	02/05/20	AS BUILT	ZJH
1	10/24/17	ISSUE FOR REVIEW AND COMMENTS	-

PE STAMP/SEAL



ONE-LINE DIAGRAM
THE MAYFAIR
100 kW DISTRIBUTED GENERATION
301 EAST 69th STREET
NEW YORK, NY 10021

CSA Engineering Services, LLC
15 TROWBRIDGE DRIVE BETHEL, CT 06801
PHONE: (203) 798-0419 FAX: (203) 743-2325

Drawn By:	Scale:	
KT	NONE	E–1.0

Appendix B

Cut Sheets for Key Sensors and Instruments

System-10
BTU Meter

ONICON's SYSTEM-10 BTU METER is the premier platform for accurately measuring and reporting the thermal energy usage, flow and temperatures required by today's High Performance Buildings.

• Chilled Water • Hot Water • Condenser Water •

727.447.6140

DESCRIPTION

The System-10 BTU Meter provides highly accurate thermal energy measurement in chilled water, hot water and condenser water systems based on signal inputs from two matched temperature sensors (included) and any of ONICON's insertion or inline flow meters which are ordered separately. The basic model provides a local indication of energy, flow and temperature data through an alphanumeric display. An isolated solid state dry contact is provided for energy total. Optional analog outputs and network communications are also available.

Whether it's used for chiller plant optimization, CEP monitoring and control, or sub-metering the hydronic energy use across a campus, the System-10 has the versatility and functionality required to integrate seamlessly with your BMS/EMS.

APPLICATIONS

Chilled water, hot water and condenser water systems for:

- Commercial office tenant billing
- Central plant monitoring
- University campus monitoring
- Institutional energy cost allocation
- Performance/efficiency evaluations
- Performance contracting energy monitoring

CALIBRATION

Flow meters and temperature sensors are individually calibrated followed by a complete system calibration.

Field commissioning is also available.

FEATURES

Simple Installation and Commissioning - Factory programmed and ready for use upon delivery. All process data and programming functions are accessible via front panel display and keypad.

Single Source Responsibility - One manufacturer is responsible for every aspect of the energy measurement process ensuring component compatibility and overall system accuracy.

NIST* Traceable Calibration with Certification - Each BTU measurement system is individually calibrated using application specific flow and temperature data and is provided with a certificate of calibration.

Precision Solid State Temperature Sensors - Custom calibrated and matched to an accuracy better than ±0.15°F over the calibrated range.

Highly Accurate Flow Meters - ONICON offers a wide variety of insertion and inline type flow measurement technologies including turbine, electromagnetic and ultrasonic sensing. Each type offers unique advantages depending on the application. All ONICON flow meters are individually wet calibrated and designed to operate over a wide flow velocity range with accuracies ranging from ±0.2% to ±2.0% of rate depending on the model.

Complete Installation Package - All mechanical installation hardware, color coded interconnecting cabling and installation instructions are provided to ensure error-free installation and accurate system performance.

Serial Communications - Optional: Provides complete energy, flow and temperature data to the control system through a single network connection, reducing installation costs.

Smart button technology simplifies menu page navigation

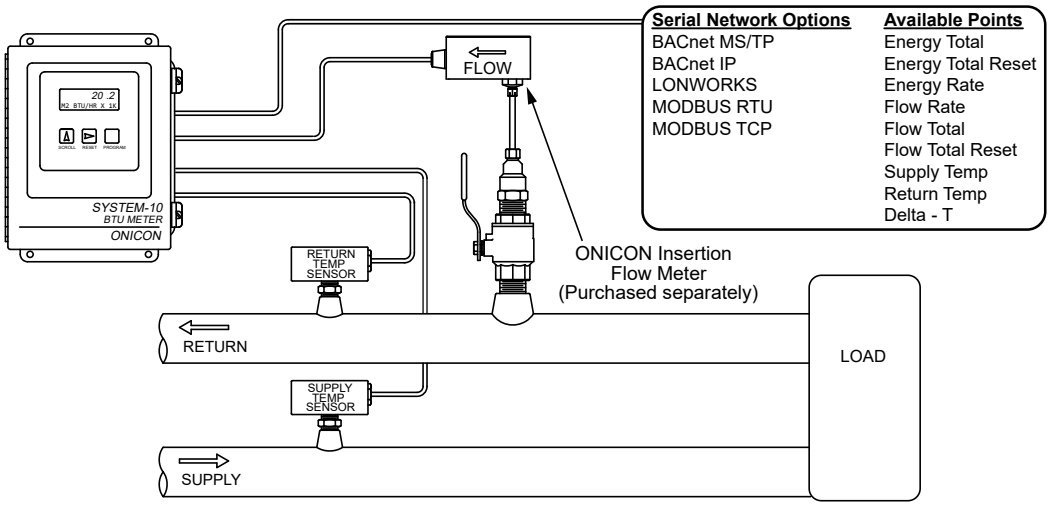
*National Institute of Standards and Technology

SPECIFICATIONS*

TEMPERATURE	Overall differential temperature measurement uncertainty of ≤ ±0.15°F over the stated range (Includes uncertainty associated with the sensors, transmitters, cabling and calculator input circuitry) Temperature sensors meet EN1434/CSA C900.1 accuracy requirements for 1K sensors for cooling applications, 32°F to 77°F. Temperature sensors meet EN1434/CSA C900.1 accuracy requirements for 2K sensors for heating applications, 140°F to 212°F.
CALCULATOR	Computing nonlinearity within ±0.05% Calculator meets EN1434 / CSA C900.1 class 1 accuracy requirements for 2K sensors for all applications.
PROGRAMMING	Factory programmed for specific application Field programmable via front panel interface
MEMORY	Non-volatile EEPROM memory retains all program parameters and totalized values in the event of power loss.
DISPLAY	Alphanumeric LCD displays total energy, total flow, energy rate, flow rate, supply temperature, return temperature, serial number and alarm status Alpha: 16 character, 0.2" high Numeric: 8 digit, 0.4" high Rate Display Range: 0 - 9,999,999 Total Display Range: 0 - 9,999,999
OUTPUT SIGNALS	Isolated solid state dry contact for energy total Contact rating: 100 mA, 50 V Contact duration: 0.5, 1, 2, or 6 sec Analog Output(s) (4-20 mA, 0-10 V or 0-5 V): One or four analog output(s) available for flow rate, energy rate, supply/return temps, or delta-T
SERIAL COMMUNICATIONS	BACnet® IP or MS/TP, MODBUS® RTU RS485 or TCP/IP, LONWORKS - TP/FT-10F, Siemens Apogee - P1, Johnson Controls Metasys - N2
TEMPERATURE SENSORS	Solid state sensors are custom calibrated using NIST traceable temperature standards. Current based signal (mA) is unaffected by wire length.
TEMPERATURE RANGE	Liquid temperature ranges based on application. See Meter Ordering Information on next page. Ambient temperature range: -20°F to 140°F
LIQUID FLOW SIGNAL INPUT	Pulse (frequency) or 4-20 mA input
MECHANICAL	**Available Electronics Enclosures:** Steel NEMA 13, wall mount, 8"x10"x4" NEMA 4 Approximate weight: 12 lbs **Temperature Sensor Thermowell Kits:** Thermowells and other kit components vary by fluid type, fluid temperature, pipe material and pipe size. Commonly used kits are listed on the previous page. Contact ONICON for additional thermowell kit options, including Hot Tap Installation Kits for retrofit installations.
ELECTRICAL	**Input Power:** Based on BTU meters configured for network connection without the analog outputs: 24 VAC, 50/60 Hz, 500 mA 120 VAC, 50/60 Hz, 200 mA 240 VAC, 50 Hz, 150 mA **Internal Supply:** Provides 24 VDC at 200 mA to electronics and select flow meters **Wiring:** Temperature signals: Use 18-22 ga twisted shielded pair Flow signals: Use 18-22 ga - see flow meter specification sheet for number of conductors.

* SPECIFICATIONS subject to change without notice.

TYPICAL INSERTION METER INSTALLATION



Serial Network Options	Available Points
BACnet MS/TP	Energy Total
BACnet IP	Energy Total Reset
LONWORKS	Energy Rate
MODBUS RTU	Flow Rate
MODBUS TCP	Flow Total
	Flow Total Reset
	Supply Temp
	Return Temp
	Delta - T

COMPATIBLE FLOW METERS

AVAILABLE OUTPUTS

METER ORDERING INFORMATION

Meter Model Number Coding = SYS-10-ABCD-EFGG

A = Electronics Enclosure

1 = NEMA 13 enclosure with LCD display

2 = NEMA 4 enclosure with LCD display

B = Input Power

1 = 24 VAC, 12 VA

2 = 120 VAC, 15 VA

3 = 240 VAC, 17.5 VA

C = Serial Communications

0 = No serial communications provided

1 = RS485, BACnet MS/TP

2 = RS485, MODBUS RTU

3 = BACnet IP

4 = MODBUS TCP/IP

5 = DualNet serial communications, IP and RS485

8 = LonWorks

D = Analog Output

0 = No analog output

1 = Single (1) isolated analog output

2 = Four (4) isolated analog outputs (Not available when C=5)

E = Auxiliary Pulse Inputs

0 = (1) Directional pulse input only

1 = (1) Directional pulse and auxiliary pulse input

F = Auxiliary Pulse Outputs

1 = Three (3) pulse outputs, dry contact

GG = Temperature Sensor

01 = Matched pair of current (mA) based sensors, CHW/CW range

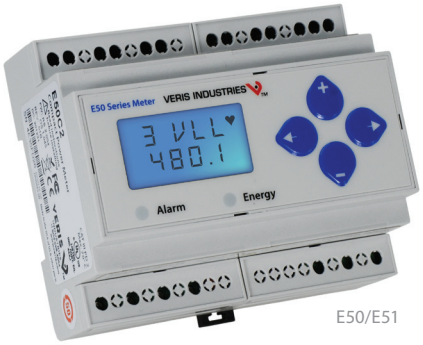
02 = Matched pair of current (mA) based sensors, HHW range

S1 = Matched pair of current (mA) based sensors, 122°F to 302°F range

S4 = Matched pair of current (mA) based sensors, 80°F to 400°F range

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.

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).

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

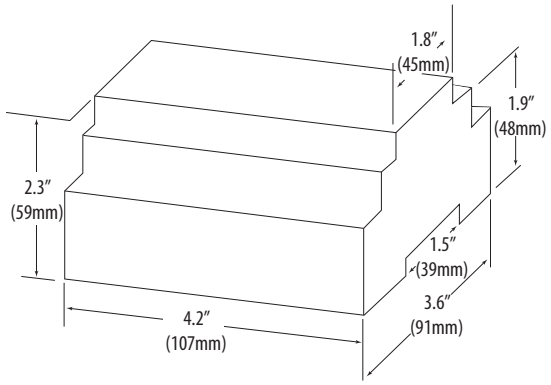
APPLICATIONS

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

ORDERING INFORMATION

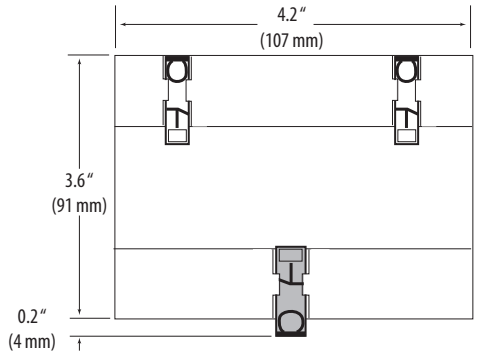
	E50B1	E50C2	E50C3	E50F2	E50F5	E50H2	E50H5	E51C2	E51C3	E51H2	E51H5
MEASUREMENT CAPABILITY - FULL DATA SET											
Bi-directional Energy Measurements									•	•	•
Power (3-phase total and per phase): Real (kW) Reactive (kVAR), and Apparent (kVA)	•	•	•	•	•	•	•	•	•	•	•
Power Factor: 3-phase average & 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



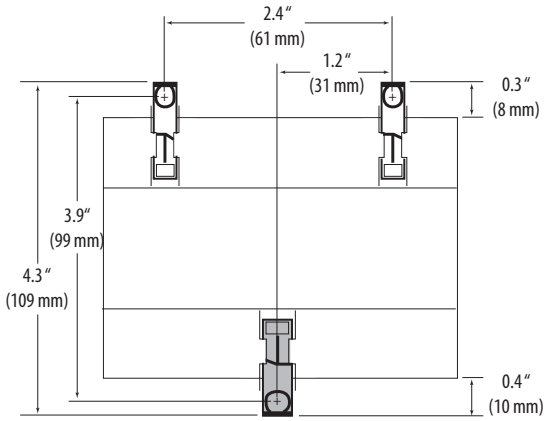
DIN MOUNT CONFIGURATION

Mounting Diagram



SCREW MOUNT CONFIGURATION

Mounting Diagram



DRESSER

ROOTS Meters & Instruments

DATA SHEET

SERIES B3: 3M175 ROOTS® Meter

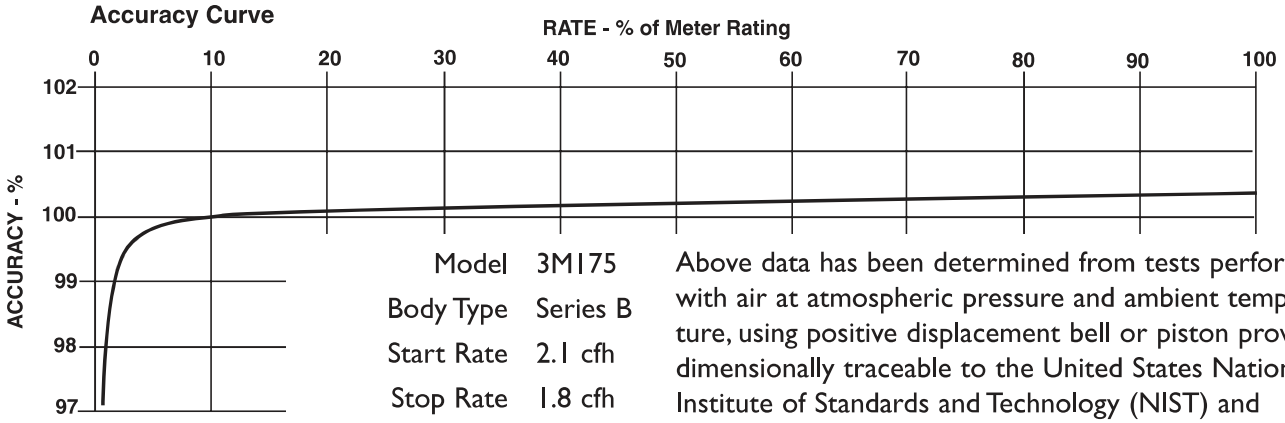
Or Similar Gas Meter with Pulse Output

	UNITS	Imperial	UNITS	Metric
Temperature Range	deg. F	-40 to +140	deg. C	-40 to +60
Base Rating (Q Max.)	acfh	3000	m^3/h	85
Max. Operating Pressure (MAOP)	psig	175	kPa	1200
Leak Test (125% MAOP)	psig	219	kPa	1510
Static Test (2 x MAOP)	psig	350	kPa	2400
Rangeability +/- 1%	ratio	76:1	ratio	76:1
Rangeability +/- 2%	ratio	139:1	ratio	139:1
Start Rate	cfh	2.1	m^3/h	0,0595
Stop Rate	cfh	1.8	m^3/h	0,0510
Flow Rate @ 0.5" w.c., Gas	cfh	2580	m^3/h	73,1
Avg. Differential, 100% Flow	in. w.c.	1.1	mbar	2,6
Max. Pressurization Rate	psig/sec	5	kPa/sec	35
Max. Operating Speed	rpm	2000	rpm	2000
Gear Ratio	ratio	400:1	ratio	141,1764:1
Displaced Volume/Revolution	cf	0.025	m^3	0,000708
Drive Rate, CD	cf/rev	10	m^3/rev	0,1
Drive Rate, TD	cf/rev	100	m^3/rev	1
Temp. Compensating Range (TC, TD)	deg. F	-20 to +120	deg. C	-29 to +49
Min. Odometer Reading	cf	0.2	m^3	0,002
Odometer Turnover	yrs.	3.8	yrs.	1,34
Nominal Pipe Size	in.	2	mm	50,8
Flange-to-Flange	in.	6-3/4	mm	172
Flange Connection	ANSI	125#FF	ANSI	125#FF
Bolts per Flange	qty.	4	qty.	4
Bolt Size[1]	in.	5/8 - 11	in.	5/8 - 11
Flange Bolt Hole Depth	in.	15/16	mm	23,8
Bolt Torque: Lubricated/Non-Lub.	ft.-lb.	55/60	N-m	74/81
Restricting Orifice (120%)	in.	17/32	mm	9,525
Oil Capacity – Side Inlet	oz.	1.25	ml	37
Oil Capacity – Top Inlet	oz.	7.65	ml	226
Counter Version (CTR)[2]				
Net Weight	lbs.	29	kg	13,2
Shipping Weight	lbs.	31	kg	14,1
Carton Size	in.	27 x 11 x 9	cm	69 x 28 x 23
Counter with Instrument Drive (CD)[2]				
Net Weight	lbs.	33	kg	15,0
Shipping Weight	lbs.	38	kg	17,2
Carton Size	in.	31 x 15 x 13	cm	79 x 38 x 33

NOTES:

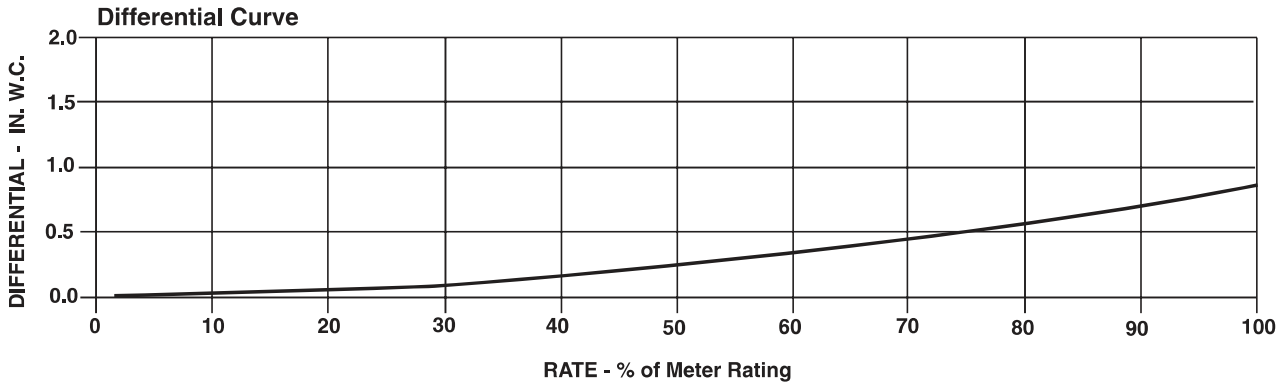
[1] Bolt Length varies by application.

[2] Weights and dimensions available for CPS, TC, TD, TPS upon request.

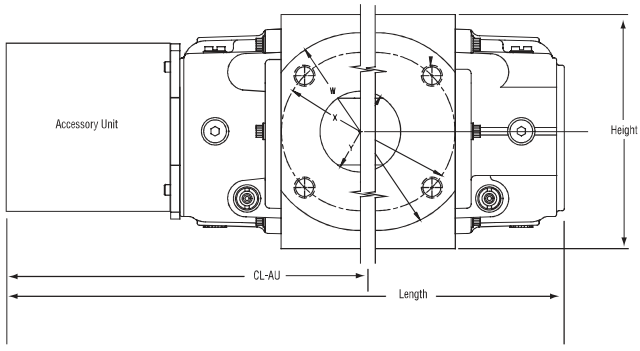


Model	3M175
Body Type	Series B
Start Rate	2.1 cfh
Stop Rate	1.8 cfh
Rangeability ±1%	76:1
Rangeability ±2%	139:1

Above data has been determined from tests performed with air at atmospheric pressure and ambient temperature, using positive displacement bell or piston provers dimensionally traceable to the United States National Institute of Standards and Technology (NIST) and traceable to NMi - Netherlands Measurements Institute for volumetric flow rate.



3M175 Series B3	Overall Length inches	mm	Overall Height inches	mm	Width (Flange/Flange) inches	mm	Centerline to Accessory End (CL-AU) inches	mm	Request Detailed Drawing Number
CTR / TC	17-1/8	435	6-31/32	177	6-3/4	172	10-7/8	276	D054517-000
CD / TD	20-31/32	533	6-31/32	177	6-3/4	172	14-23/32	374	D054431-000
CPS / TPS	9-1/4	489	6-31/32	177	6-3/4	172	13	330	D054670-000
IMC/C	20-5/8	524	6-31/32	177	6-3/4	172	14-3/8	365	D056486-000
IMC/W	21-5/8	549	6-31/32	177	6-3/4	172	15-3/8	391	D056702-000



To order

Specify: Meter Series, Size and Type (i.e., ROOTS Meter Series B3 3M175 CD).

For CD or TD, specify Inlet (Top or Side) and ID Rotation (CW-B or CCW-A).

For Pulser, specify Single or Dual Connectors and Connector Type (MS Circular, Conduit or Cable Gland).

For more specific ordering information on the electronic products, request: TS:SSP, TS:IMC/C or S:IMC/W.

Contact the factory for other available information, options, or special requests.

DRESSER
Roots Meters & Instruments

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