# PHOTOVOLTAIC SYSTEM FOR CHA - BELMONT MIDDLE & HIGH SCHOOL 221 CONCORD AVENUE, BELMONT MA 02478



1,135.99 kWdc (840.00 kWac) PV ARRAY WITH 2,417QTY 470W MODULES AT 5° TILT

(1)

5° FIXED TILT ROOFTOP ARRAY

TOTAL	2,417/ 470W	-	1,135.99 kWdc	840.00 k
DF	989/ 470W	160.1°, 167.1°, 177.1°, 180.1°	464.83 kWdc	360.00 k
ABC	1,428/ 470W	160.1°, 167.1°, 208.1°	671.16 kWdc	480.00 k
SYSTEM	MODULES	AZIMUTH	DC POWER	AC POV

TOTAL ARRAY SIZE (kWdc)	1,135.99
MODULE MODEL	Q.PEAK DUO XL-G10.2-470
TOTAL NUMBER OF MODULES IN ARRAY	2,417
MODULE WATTAGE	470
NUMBER OF STRINGS	63
NUMBER OF MODULES PER STRING	32-42
TILT	5°
SOLAR AZIMUTH	160.1°, 167.1°, 177.1°, 180.1° & 208.1°
MOUNTING SYSTEM	PANELCLAW CLAWFR5D
INVERTER MODEL	(7) SE120K-US
TOTAL SYSTEM SIZE (kWac)	840.00

97.121% INV EFFICIENCY

0 32' 64' 128'



ESTIMATED ANNUAL ENERGY PRODUCTION BASED ON: **PVWATTS CALCULATOR** LAT, LON 42.41, -71.18 WEATHER DATA PREMIUM MODULE 16% SYSTEM LOSSES FIXED TILT (ROOF MOUNT)





	SHEET INDEX
ID	Name
PV001	PV SITE PLAN
PV002	PV SYSTEM NOTES
PV101	PV LAYOUT
PV102	INVERTER SOURCE
PV103A	PV DIMENSIONED LAYOUT, A
PV103B	PV DIMENSIONED LAYOUT, B
PV103C	PV DIMENSIONED LAYOUT, C
PV103D	PV DIMENSIONED LAYOUT, D
PV103F	PV DIMENSIONED LAYOUT, F
PV201A	SRC CIRC & COND. PLAN, A
PV201B	SRC CIRC & COND. PLAN, B
PV201C	SRC CIRC & COND. PLAN, C
PV201D	SRC CIRC & COND. PLAN, D
PV201F	SRC CIRC & COND. PLAN, F
PV202A	OPTIMIZER LAYOUT, A
PV202B	OPTIMIZER LAYOUT, B
PV202C	OPTIMIZER LAYOUT, C
PV202D	OPTIMIZER LAYOUT, D















CONDUITS TO TERMINATE AT WIRE

## **INVERTERS 5 THRU 7 MOUNTING BRACKET ELEVATION**



0 6'' 1'

solar design associates HARVARD, MA 01451-0242 tel: 978-456-6855 www.solardesign.com fax: 978-772-9715 NOTFORCONSTRUCTION THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. CERTIFICATION OR VALIDATION IS TO BE DONE BY A PROFESSIONAL WITH EXPERTISE IN THE REQUIRED FIELD AND A LICENSE IN THE STATE THAT THE INSTALLATION WILL RESIDE. CERTFICIATION OR VALIDATION TO BE INCLUDED AS PART OF THE SUBMITTALS FOR PERMITTING OF THE OVERALL PROJECT. CHA - BELMONT MIDDLE & HIGH SCHOOL 90% CD SET Thursday, June 23, 2022 IAM NAL ST F UNUSED D C DESCRIPTION MARK DATE 04/26/2022 SCHEMATIC DESIGN 05/31/2022 90% CD SET MAME **NOTES** NAME CHA - BELMONT MIDDLE & HIGH SCHOOL STREET 221 CONCORD AVENUE E CITY/ST/ZIP BELMONT, MA 02478 NOTES FILE NAME 2022-0327 Belmont High School.pln SCALE AS NOTED DRAWN BY NL, CW DATE DRAFTED: 6/23/2022 CHECKED BY SMC, TP SHEET SIZE: ARCH D PV502 DRAWING NO. **INVERTERS 5 THRU 7** DRAWING TITLE MOUNTING



\_ 3/8"-16x1" STAINLESS HEX SCREW, TORQUE: 20 FT-LBS

3/8" STAINLESS LOCK WASHER

3/8"X 1" O.D. STAINLESS FLAT WASHER

0 1/2" 1" 2"

	HAR	solar design associates e ARD, MA 01451-0242 solardesign.com
	NOTEC	UR CONSTRUCTION
T V	THIS DRAWING IS FOR VALIDATION IS TO BE REQUIRED FIELD ANI VILL RESIDE. CERTFIC THE SUBMITTALS	INFORMATION PURPOSES ONLY. CERTIFICATION OR DONE BY A PROFESSIONAL WITH EXPERTISE IN THE D A LICENSE IN THE STATE THAT THE INSTALLATION IATION OR VALIDATION TO BE INCLUDED AS PART OF S FOR PERMITTING OF THE OVERALL PROJECT.
	CH/ MIE	A - BELMONT DDLE & HIGH SCHOOL
BMISSION	90% CD SET	T 3 2022
PROFESSIONAL STAMP SI		
	B	E UNUSED C D F
REVISION NOTES	MARK DATE - 04/26/202 - 05/31/202 -	DESCRIPTION 22 SCHEMATIC DESIGN 22 90% CD SET
CONTRACTOR	NAME STREET CITY/ST/ZIP NOTES	
SITE	NAME STREET CITY/ST/ZIP NOTES	CHA - BELMONT MIDDLE & HIGH SCHOOL 221 CONCORD AVENUE BELMONT, MA 02478
DRAWING	FILE NAME SCALE DRAWN BY CHECKED BY DRAWING NO.	2022-0327 Belmont High School.pln AS NOTED NL, CW DATE DRAFTED: 6/23/2022 SMC, TP SHEET SIZE: ARCH D PV503







## 840.0 kWac (1,135.99 kWdc) PV SINGLE LINE

(1

	POWER OPTIMIZER SOURCE CIRCUIT OUTPUT		
	Maximum Output Voltage:	1000	Vdc
-470	Typical Operating Voltage:	850	Vdc
	Shutdown Standby Voltage:	16	Vdc
	Maximum Current:	18	Adc
	Typical Operating Current:	13.3	Adc
	PV INVERTER OUTPUT (SE120KUS)		
	Max Rated Power	120	kWac
	Max Ouput Power	120	kWac
	Operating Voltage (Line-to-Line):	480	Vac 3-PHASE
	Max Current:	145	Aac
	Output Frequency:	60	Hz

			2,417			
ES IN PARALLEL						
CURRENT, 277/480Vac OUTPUT, INTE	EGRATED DC DISCON	INECT, AFCI,	7			
R, 3P/4W, 65 KAIC, BRANCH BREAKERS	SAS NOTED, NEMA1,	FOR	1			
, 3P/4W, 65 KAIC, BRANCH BREAKERS E AND F	SAS NOTED, NEMA1,	FOR	1			
OUTY, 277/480VAC, 800A BLADE UNFUSED, CONTINUOUS DUTY RATED, SIBLE 24/7/365, RAPID SHUTDOWN INTIATION POINT						
TY, 277/480VAC, 600A BLADE UNFUSE SIBLE 24/7/365, RAPID SHUTDOWN IN	ED, CONTINUOUS DU ITIATION POINT	TY RATED,	2			
AL ROOM C154A ON FLOOR 1 , 277/48 <b>S</b>	80V, 3000A BUSBAR, 2	800A MB,	1			
CAL ROOM C154A ON FLOOR 1 , 277/48	30V, 3000A BUSBAR, 3	8000A MB,	1			
OP BUTTONS, RELAY CONTROLLER T QUIRES MANUAL CLOSING UPON TRIF	O TRIP BREAKER PE	R SETTINGS	1			
OP BUTTONS, RELAY CONTROLLER T QUIRES MANUAL CLOSING UPON TRIF	O TRIP BREAKER PE	R SETTINGS	1			
			4			
0Vac INPUT, 24Vdc OUTPUT, DIN RAIL MOUNTING						
AH (2320322), 24Vdc, DIN RAIL MOUNT	TING		4			
POCC, BY OTHERS						
S ON PT'S						
IEDIUM VOLTAGE, COMMUNICATE VIA IP OF BOTH INTERCONNECTION BRE.	MIRRORED BITS. PIC AKERS	CKUP OF	2			
RELAYS			1			
S, AND BATTERY			1			
s, QTY 3 15kV RATED PTs, RATIO TBD	, WYE:WYE TOPOLOO	GY, NEMA 3R	2			
			2			
DR EQUIVALENT			2			
PECIFIED			1			
2: TRIP LEVEL SETTINGS TO STOP I	NVERTER	V <sub>NOM</sub> = 277V	/ L-G			
DESCRIPTION	SET POINT	TOTAL CLEA	R TIME			
E UNDER VOLTAGE (FAST) 138.5 V 1.1 SEC						
E UNDER VOLTAGE (SLOW) 243.7 V 2.0 SEC						
E OVER VOLTAGE (SLOW) 304.7 V 2.0 SEC						
E OVER VOLTAGE (FAST) 332.4 V 0.16 SEC						
E UNDER FREQUENCY (FAST) 56.5 Hz 0.16 SEC						
E UNDER FREQUENCY (SLOW) 58.5 Hz 300 SEC						
E OVER FREQUENCY (SLOW) 61.2 Hz 300 SEC						
E OVER FREQUENCY (FAST)	62.0 Hz	0.16 SEC	;			

1. INVERTER TOTAL CLEARING TIME INCLUDES MECHANICAL OPERATION TIME OF 3 CYCLES (0.05s) UTILITY RESTORATION DECTECTION WILL USE THE FACTORY SETTINGS FOR A UL 1741 SA CERTIFIED INVERTER.

**<u>GROUNDING NOTES</u>** 1. PV INVERTER GEC TO BE SIZED PER NEC 250.166. COPPER GROUNDING ELECTRODE ROD 3/4" x 10' MIN TO BE USED.

2. TRANSFORMER GEC TO BE SIZED PER NEC 250.66. COPPER GROUNDING ELECTRODE ROD 3/4" x 10' MIN TO BE USED. FROM

TRANSFORMER EARTH GROUND TO COPPER GEC, GROUND SYSTEM RESISTANCE SHALL BE 25 OHMS OR LESS.

	NOMINAL	PRIMARY VOLTAGE L-G: TBD k
PRI. PICKUP	SEC. PICKUP	TOTAL CLEAR TIME
kV TBD	240.0 V	75 CYC (1.25 SEC)
TBD kV ≤ V ≤ TBD kV	114.0 V ≤ V ≤ 126.0 V	
59.5 Hz ≤	f ≤ 60.5 Hz	

RELAY WILL TRIP OFFLINE IN 2 SECONDS OR LESS UPON LOSS OF DC SUPPLY POWER AND PREVENT MANUAL CLOSING OF THE SHUNT TRIP

4. ANY LOSS OF DC POWER TO RELAY OR RELAY FAILURE WILL TRIP AND BLOCK CLOSE OF THE INTERCONNECTION BREAKERS IN 2 SECONDS OR

8. INTERCONNECTION INTERRUPTING DEVICE SHALL HAVE DC TRIP COILS AND TRIPPING ENERGY SHALL BE DERIVED FROM 24VDC UPS-STYLE

VOLTAGE DROP⁴	NEUTRAL SIZE	GROUND SIZE	MINIMUM CONDUIT SIZE
~1.500%	N/A	#6 Cu PV WIRE 2000V <sup>5</sup>	OPEN AIR / SCH 40 & 80 PVC / RMC
1.338%	#6 AI THWN-2	#6 AI THWN-2	2" IMC (OUTSIDE) / EMT (INSIDE)
0.720%	#4 AI THWN-2	#4 AI THWN-2	2" IMC (OUTSIDE) / EMT (INSIDE)
0.816%	400 kcmil Al THWN-2	2/0 AI THWN-2	3 SETS 4" EMT
1.409%	400 kcmil Al THWN-2	2/0 AI THWN-2	3 SETS 4" EMT

		solar design associates:
	HAR∖ www.	/ARD, MA 01451-0242 tel: 978-456-6855 solardesign.com fax: 978-772-9715
		TION
		CONSTRUCTIO
	NOTFO	RUU
	,	
-	THIS DRAWING IS FOR VALIDATION IS TO BE	INFORMATION PURPOSES ONLY. CERTIFICATION OR DONE BY A PROFESSIONAL WITH EXPERTISE IN THE
V	VILL RESIDE. CERTFIC THE SUBMITTALS	A LICENSE IN THE STATE THAT THE INSTALLATION IATION OR VALIDATION TO BE INCLUDED AS PART OF S FOR PERMITTING OF THE OVERALL PROJECT.
	CH/ MIF	A - BELMONT DI F & HIGH
		SCHOOL
<b>MISSION</b>	90% CD SET	-
SUE	Thursday, June 2	3, 2022
AL STAMF		
<b>FESSION</b>		
PRO		
		Ε
l r		
	В	
	A	
	MARK DATE	DESCRIPTION
IN NOTES	- 05/31/202	22 90% CD SET
REVISIO		
-OR	NAME	
<b>ONTRACT</b>	STREET CITY/ST/ZIP NOTES	
Ö	NAME	CHA - BELMONT MIDDLE & HIGH SCHOOL
SITE	CITY/ST/ZIP NOTES	BELMONT, MA 02478
	FILE NAME SCALE	2022-0327 Belmont High School.pln AS NOTED
VING	DRAWN BY CHECKED BY	NL, CWDATE DRAFTED: 6/23/2022SMC, TPSHEET SIZE: ARCH D
DRAV	DRAWING NO.	PV602
	DRAWING TITLE	SINGLE LINE



BORNALLA DEL MONTER-CENTRALES EN LA CONTRALES EN LA CONTRES EN LA CONTRALES EN LA CONTRES EN LA CONTRALES EN LA CONTRALES												
Inspersion of FOR INFORMATION PURPOSES ONLY. CERTECATION OR WALDATION IS TO BE OWNE PRA PROFESSIONAL WITH EXPERTISE IN THE REQUIRED HELD AND ALLOPASE IN THE STATE THAT THE INSTITUTION WILL RESIDE CERTIFICATION OR WALDATION TO BE INJUDIED AS PART OF THE SUBMITALS FOR PERMITTING OF THE OVERALL PROJECT.         CHAA - BELLMONT MIDDLE & HIGH SCHOOL         OPO% CD SET         10055000000000000000000000000000000000			HARV	SC de as	)   a ) S ( ) S ( 1A 01451- sign.com	0242	Inclassifier (197) fax: 97	<b>ate</b> 8-456-685 78-772-97	<b>35</b> <u>6</u> 15			
Mediume Pielu Ana ALCENSE IN THE STATE THAT THE INSTALLATION         WILL RESIDE CERTICIONION ON VALIDATION TO ENCLUDED AS PART OF         CHAA - BELMONT         MIDDLE & HIGH         SCHOOOL         NOT THE SUBMITTALS FOR PERMITTING OF THE OVERALL PROJECT.         OPUS         MARK DATE       DESCRIPTION         OPUS       OPUS <th colspan="2" t<="" th="" us<=""><th></th><th></th><th></th><th>JR INFORI</th><th></th><th></th><th>RUC DISES ONL ONAL WI</th><th>J. CERTI TH EXPER</th><th>N FICATION OF RTISE IN THE</th><th>R</th></th>	<th></th> <th></th> <th></th> <th>JR INFORI</th> <th></th> <th></th> <th>RUC DISES ONL ONAL WI</th> <th>J. CERTI TH EXPER</th> <th>N FICATION OF RTISE IN THE</th> <th>R</th>					JR INFORI			RUC DISES ONL ONAL WI	J. CERTI TH EXPER	N FICATION OF RTISE IN THE	R
90% CD SET         Thursday, June 23, 2022         Image: Stress of the s		REQUIRE VILL RESID THE	D FIELD AND DE. CERTFICI SUBMITTALS	A LICE ATION FOR F FOR F )D S(	BE BE LE CH	THE ST DATION NG OF EL & O(		T THE INS NCLUDED RALL PR	STALLATION ) AS PART OI OJECT.	F		
A A A A A A A A A A A A A A A A A A A	JBMISSION	90% Thursd	CD SET	<u>-</u> 3, 202	2							
Image: Street Control of	PROFESSIONAL STAMP SI											
MARK DATE DESCRIPTION - 04/26/2022 SCHEMATIC DESIGN - 05/31/2022 90% CD SET - 05/31/2022 - 05/31/2022 90% CD SET - 05/31/2022 - 05/31/2022 - 05/31/2022 - 05/31/20	ĺ	B	A	C	E UN		D	F	7			
NAME         STREET         CITY/ST/ZIP         NOTES         NOTES         NAME         CHA - BELMONT MIDDLE & HIGH SCHOOL         STREET         221 CONCORD AVENUE         CITY/ST/ZIP         BELMONT, MA 02478         NOTES         FILE NAME         2022-0327 Belmont High School.pln         SCALE         AS NOTED         DRAWN BY         NL, CW       DATE DRAFTED: 6/23/2022         CHECKED BY       SMC, TP         SHEET SIZE: ARCH D         DRAWING NO.       PV603         DRAWING TITLE       DAS SINGLE LINE	REVISION NOTES	MARK	DATE 04/26/202 05/31/202	22		D SCHI	ESCRI EMATIO 90% CE	PTION C DESI D SET	GN			
NAME CHA - BELMONT MIDDLE & HIGH SCHOOL STREET 221 CONCORD AVENUE CITY/ST/ZIP BELMONT, MA 02478 NOTES FILE NAME 2022-0327 Belmont High School.pln SCALE AS NOTED DRAWN BY NL, CW DATE DRAFTED: 6/23/2022 CHECKED BY SMC, TP SHEET SIZE: ARCH D DRAWING NO. PV603 DRAWING NO. DATE DAS SINGLE LINE	CONTRACTOR F	NAME STREE CITY/S NOTES	T T/ZIP S									
FILE NAME       2022-0327 Belmont High School.pln         SCALE       AS NOTED         DRAWN BY       NL, CW       DATE DRAFTED: 6/23/2022         CHECKED BY       SMC, TP       SHEET SIZE: ARCH D         DRAWING NO.       PV603         DRAWING TITLE       DAS SINGLE LINE	SITE	NAME STREE CITY/S NOTES	T T/ZIP	CHA 221 BEL	<u>- BELM</u> CONCO MONT,	IONT ORD MA (	MIDDLI AVENU 02478	E & HIG JE	H SCHOO			
	DRAWING	FILE NAM SCALE DRAWN CHECKE DRAWIN	AE BY D BY G NO. G TITLE	2022- AS NO NL, C SMC,	DIED DTED W TP	DAT	igh Schoo TE DRAF SHEET S V60 SINGL	1.pln TED: 6/2 SIZE: AR 13 LE LIN	23/2022 CH D			

SIZE (MIN)	CABLE QTY	FUNCTION
IMC	6	DATAACQUISITION SYSTEM CT WIRES
4+G DATAACQUISITION SYSTEM VT 8		DATAACQUISITION SYSTEM VT & POWER
'x1" WIRE DUCT	1	INVERTER DATACONNECTION - RS485
DECK/OPEN AIR	1	WEATHER STATION POWER & DATA
" IMC	1	INTERNET CONNECTION

	2
	1
	1
WEATHER SENSORS	1
SC151506NK OR EQUIVALENT	2
REQUIVALENT	2
WND-WR-MB	2
	2
V, REVENUE GRADE	3
V, REVENUE GRADE	3
ATOR CFS-3PCC30 OR EQUIVALENT	2