FOR CONTRACT NO.: 10-0U6204

INFORMATION HANDOUT

MATERIALS INFORMATION

1. CORROSION INVESTIGATION OF COLUMNS AT BILLY WRIGHT RD UC (10-MER-5 PM 16.72)

2. INSTALLATION DETAILS FOR BATTERY BACKUP SYSTEM

ROUTE: 10-Mer-5-16.7

State of California Business, Transportation and Housing Agency

Memorandum

To: JAMES SAGAR
Division of Structures Maintenance & Investigations
Office of Structures Investigations - North

Date: June 15, 2001

File: Billy Wright Rd UC
10-MER-5 PM 16.72
Bridge No. 39-0160L&R
EA 59-5T1000

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES - MS #5

Subject: Corrosion Investigation of Columns at Billy Wright Rd UC (10-MER-5 PM 16.72)

On May 23, 2001, staff from the Materials Engineering and Testing Services (METS) Corrosion Technology Branch and Structures Maintenance & Investigations – North conducted a joint field review of the Billy Wright Rd UC at 10-MER-5 PM 16.72 (Bridge Nos. 39-0160 L & R). Unsound concrete was removed and collected and soil was sampled for corrosion testing. This memorandum summarizes the results of the concrete and soil testing and the corrosion investigation, and provides corrosion recommendations for the columns.

Site Description

The Billy Wright Rd UC at 10-MER-5 PM 16.72 is a three-span left and right structure constructed in 1971. The diaphragm abutments are founded on spread footings in fill material. Bents 2 and 3 are constructed of seven columns each that extend from spread footings in original ground. The bottoms of the bent footings vary from 1.5 m to 3 m below grade. The columns are 400 mm in diameter. The left and right structures have similar design.

During routine bridge inspections, Structures Maintenance & Investigations – North discovered cracked and spalled concrete and severely corroded reinforcing steel at the soil line to a depth of approximately 300 mm. This deterioration is present at most columns of Bents 2 and 3 of both the left and right structures. The columns at Bents 2 and 3 are located in drainage ditches that fill with stormwater runoff when it rains.

Field Investigation

In order to assist in developing a maintenance strategy to rehabilitate the deteriorated columns, a field investigation was conducted. On May 23, 2001, soil around a few of the damaged columns was excavated to a depth of 0.6 m in order to determine the vertical extent of damage below grade. Unsound concrete was chipped and hammered,

exposing corroded reinforcing steel, so that concrete fragments could be collected for corrosion testing. It appears that the deteriorated concrete and corroded reinforcing steel is consistent at all columns. The damage extends from the soil line to a depth of 300 mm to 600 mm. Since there is no damage above the soil line, there must be a chemical or corrosion reaction with the soil. Confinement steel was entirely corroded, and there is significant section loss of vertical reinforcement.

In addition to concrete samples, soil was collected for corrosion testing. Soil around a column at the surface was collected. Soil was also collected at a depth of 0.6 m, which was just below the depth of damage. In addition, a surface sample was collected remote from the columns and stormwater drainage ditch.

Test Results

Corrosion test results of soil and concrete samples collected on May 23, 2001 are attached. Concrete was tested in accordance with California Test Method (CTM) 404, while soil was tested in accordance with CTMs 643, 422, and 417.

The chloride concentration in concrete at the depth of the reinforcing steel determines how long the reinforcing steel will remain passivated by the high pH of the concrete environment. As the level of chloride increases, this passive condition is threatened. The Department's rule of thumb assumes that chloride concentrations at the depth of the reinforcing steel greater than 1.2 lb/yd^3 can cause active corrosion of the reinforcing steel.

The chloride contents of the unsound concrete fragments ranged from 5.2 lb/yd^3 to 13.2 lb/yd^3. These chloride levels, especially at the 40-mm to 50-mm depth of the reinforcing steel, are well above the 1.2 lb/yd^3 corrosion threshold. With such high chloride levels in the concrete as well as moisture and oxygen availability, we would expect the reinforcing steel to corrode, causing the concrete to delaminate from the rebar. Eventually, the concrete cracks and spalls.

Soil test results show that the soil, particularly surface soil in the drainage ditch, is corrosive. Chloride content of the surface soil in the drainage ditch was 1,500 ppm, which is greater than the Department's 500-ppm chloride criteria for corrosive soil. In addition to chlorides from the soil diffusing into the concrete columns and causing the rebar to corrode, sulfate content in the soil is also corrosive. Sulfate content of the surface soil in the drainage ditch was 6,600 ppm, which is greater than the Department's 2,000-ppm sulfate criteria for corrosive soil. Although sulfates do not attack the reinforcing steel, sulfates deteriorate concrete and cause cracking. This cracking allows additional chlorides to diffuse into the concrete and promote corrosion of the rebar.

In addition to corrosion testing of soil and concrete, the concrete fragments were also evaluated for alkali silica reactivity (ASR) and carbonation. As advised by the TransLab's Aggregates/Cementitious Materials Specialist, the concrete is not deteriorating from ASR. There were no white salt deposits characteristic of ASR, and the aggregate was firmly attached to the cement. Also, there was no prominent cracking of the columns that is characteristic of ASR.

A carbonation test of the concrete fragments using phenolphthalein showed that carbonation has occurred to a depth of 25 mm, which is greater than expected for good quality structural concrete. Soil moisture near the surface, availability of carbon dioxide, and wet/dry cycling has probably contributed to increased carbonation of the concrete. These conditions are also conducive to corrosion near the soil surface.

In summary, all of the test data suggests both chlorides and sulfates in the soil are causing corrosion of the reinforcing steel and deterioration of concrete. Moisture and oxygen availability near the surface is optimal for corrosion. A lack of moisture and oxygen below the surface limits corrosion to the top 300 mm of the columns. Stormwater runoff in the drainage ditch increases the chloride and sulfate concentration in the surface soil in the drainage ditch.

Corrosion Mitigation Recommendations

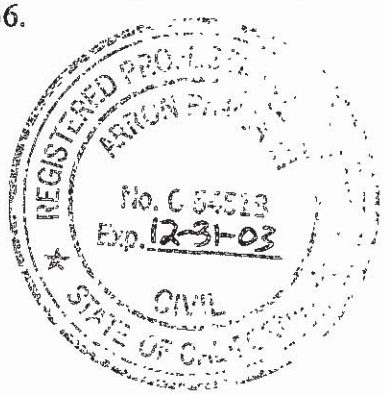
- If not already done, the extent of unsound concrete and corroded reinforcing steel must be determined at all of the columns at Bents 2 and 3 of both the left and right structures. It must be determined how deep below the soil line the problem extends (and how deep into the center of the column). The best way to establish the extent of the corrosion is to perform a delamination survey of the columns to determine the extent of unsound and delaminated concrete. Unsound and delaminated concrete is generally that concrete which emits a relatively dead or hollow sound when a chain is dragged over its surface or its surface is tapped with a metal hammer.
- An investigation and delamination survey for unsound concrete should also be performed on the abutments where the concrete is in contact with soil. A delamination survey at the abutments could identify unsound concrete and corroded rebar.
- Corroded rebar and unsound concrete should be removed and replaced, unless otherwise specified by the Caltrans Structures representative. Rebar with appreciable section loss due to corrosion should be cut and replaced. Rebar with minor corrosion should be cleaned by abrasive blast. SSP 15-940 specifies removal of unsound concrete.

- Patch chipped out voids with a Department-approved patching material. Patching should conform to SSP 51-820, "Portland Cement Concrete Patches". Prior to patching with portland cement concrete, a bond coat of epoxy adhesive must be applied in accordance with SSP 51-810.
- After patching, the repaired columns should be protected from future corrosion from the soil line to a depth of approximately 0.6 m below the affected area. Application of a barrier coating will prevent chlorides and sulfates in the soil, as well as moisture and oxygen from contacting the concrete. Waterproofing in accordance with Standard Specification Section 54 can be used as a barrier coating. Another barrier coating is a high build epoxy mastic coating. The METS's Chemical Testing Branch can provide a list of qualified epoxy mastic coatings or a specification, if necessary.

If you have any questions regarding our comments, please call my senior, Doug Parks, at (916) 227-7007 or me at (916) 227-7236.

Arron Rambach

ARRON RAMBACH, P. E.
Transportation Engineer (Civil)
Corrosion Technology Branch



Reviewed By:

Arron Rambach

for DOUGLAS M. PARKS, Chief
Corrosion Technology Branch

Attachments (soil and concrete corrosion test results)

c: Rob Reis, Corrosion Technology Branch (w/ attachments)
Susan Hall, Corrosion Technology Branch (w/ attachments)
John Muiruri, Corrosion Technology Branch (w/ attachments)

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
CORROSION TEST SUMMARY REPORT

REPORT BY: Susan Hall,
Corrosion Technology Section

MATERIAL SOURCE: 10 - Mer - 5 - PM 16.72
SAMPLE OF: Soil
EA : 59-5T1000

SIC NUMBER	CORROSION NUMBER	SAMPLE FROM	LOCATION	SAMPLE DEPTH	DATE SAMPLED	pH	MINIMUM RESISTIVITY (ohm-cm)	SULFATE CONTENT (PPM or mg/kg)	CHLORIDE CONTENT (PPM or mg/kg)	SOLUBLE SODIUM (PPM or mg/kg)	SOLUBLE POTASSIUM (PPM or mg/kg)
C239185	01-0524	Bent 2, Column 7	Billy Wright Road UC, Br. #39-0160R	Surface	5/23/2001	7.8	300	6600	1500	460	11
C239186	01-0525	Bent 2, Column 2	Billy Wright Road UC, Br. #39-0160L	24"	5/23/2001	7.6	580	1900	380	32	6
C239187	01-0526	Remote Soil Adjacent to Bent 2, Column 7	Billy Wright Road UC, Br. #39-0160R	Surface	5/23/2001	7.5	580	4600	640	21	5

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, or more than 2000 ppm of sulfates, or has a minimum resistivity of less than 1000 ohm-centimeters, or has a pH of 5.5 or less.
With the exception of MSE Walls, chloride and sulfate tests (CTM 422 and CTM 417) are not required (N/A) if the minimum resistivity is greater than 1,000 ohm-cm.

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
TEST SUMMARY REPORT

REPORT BY: Susan Hall,
Corrosion Technology Section

MATERIAL SOURCE: 10 - Mer - 5 - PM 16.72

Sample of: Concrete Fragments

EA : 59-5T1000

SIC NUMBER	CORROSION NUMBER	BRIDGE NUMBER	BRIDGE NAME	LOCATION	DATE SAMPLED	CORE NUMBER	CONCRETE SAMPLE NUMBER	SAMPLE DEPTH	CHLORIDE CONTENT (Lb/Yd³)
C239184	01-0517	39-0160L	Billy Wright Road UC	Bent 2, Column 2	5/23/2001	1	1A	0"-1"	10.00
C239184	01-0518	39-0160L	Billy Wright Road UC	Bent 2, Column 2	5/23/2001	1	1B	1"-2"	13.20
C239184	01-0519	39-0160L	Billy Wright Road UC	Bent 2, Column 2	5/23/2001	2	2A	0"-1"	5.20
C239184	01-0520	39-0160L	Billy Wright Road UC	Bent 2, Column 2	5/23/2001	2	2B	1"-2"	8.00

Note: The level of chloride concentration in concrete determines how long the reinforcing steel will remain passivated by the high pH of the concrete environment. As the level of chloride increases, this passive condition is threatened. It should be noted that concrete cores taken with cracks included or through delaminated areas will cause the test results to be biased by making the chloride level in the concrete appear higher than those without cracks or delaminations. The cracks and the delaminations contain the high concentrations of chlorides. The following rules of thumb are offered here for information only.

Chloride Concentration:

kg/m³	lb/yd³	Assumed Condition
0 to 0.7	0 to 1.2	passive
0.9 to 1.8	1.5 to 3.0	corrosion initiation
> 1.8	> 3.0	active corrosion

Note: For chloride concentrations between 0.7 and 0.9 kg/m³ (1.2 and 1.5 lb/yd³), there is no consensus among researchers on the chloride concentration that initiates corrosion.

TL-101 (REV. 6-76)
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD NO. C239184

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO
☒ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. ______
DIST. LAB NO. ______
LOT NO. ______
SHIPMENT NO. ______
P. O. OR REQ. NO. ______
AUTHORIZATION NO. 59-5T1000

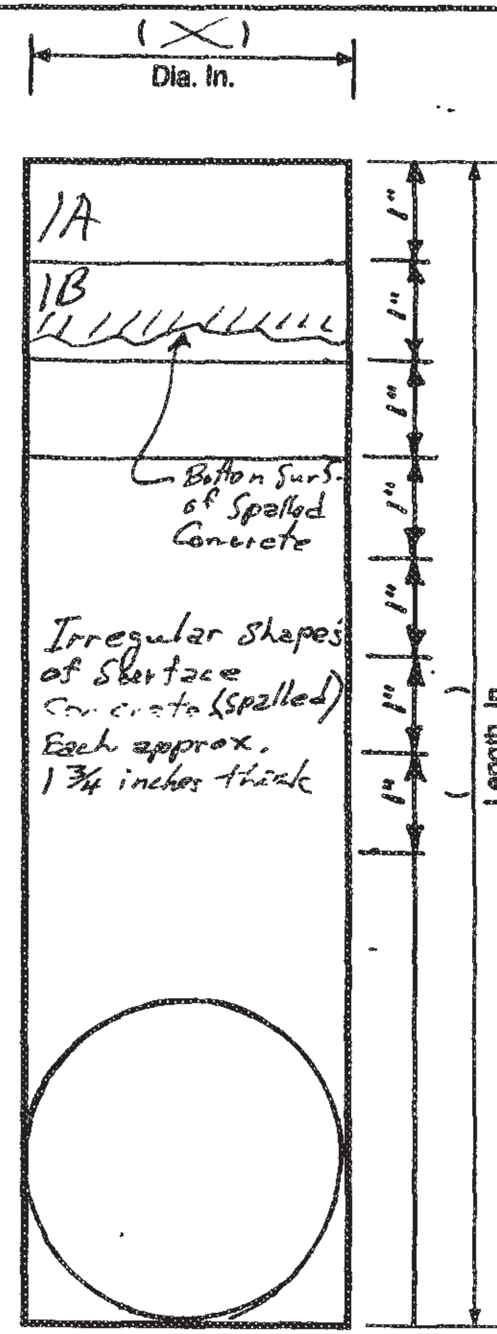
SAMPLE OF Concrete fragments
FOR USE IN [illegible]
SAMPLE FROM [illegible]
DEPTH Surface
LOCATION OF SOURCE Bridge # 39-160L Billy Wright Road UC
THIS SAMPLE IS SHIPPED IN 1 (NO. CONTAINERS) AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS., BBLS., STA., ETC.)
OWNER OR MANUFACTURER ______
TOTAL QUANTITY AVAILABLE ______ TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY DATE NEEDED 6-9-01
REMARKS CTM 404 [illegible] Tests
COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 5-23-01
BY [illegible] TITLE TE
DIST., CO., RTE., P.M. [illegible] PM 16.72
LIMITS Test results to James Sager 227-8246 of Structures Maintenance
CONT. NO. /
FED. NO.
MAY 23 2001
RES. ENGR. OR SUPT. [illegible] 227-7236
ADDRESS Send results to James Sager of Structures
CONTRACTOR Maintenance

SAMPLER'S COPY

CONCRETE CORE SAMPLE INFORMATION

EA No. 59-5T1000
SIC No. C-239184
Bridge No. Br # 39-160L
Dist. 10 Co. Mer Rte. 5
Date Rec'd. 5-23-01 P.M. PM 16.72
Sample No. 1, Spalled Concrete

Field No.	Core No. (1) Section	Corrosion No.
	1 A	01-0517
	1 B	-0518
	C	
	D	
	E	
	F	
	G	
	H	
	I	
	G	
	K	
	L	
	M	
	N	
	O	
	P	
	Q	
	R	
	S	
	T	
	U	
	V	
	W	
	X	
	Y	
	Z	



TL-101 (REV. 6-76)
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD NO. C239184

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO
☒ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO.
DIST. LAB NO.
LOT NO.
SHIPMENT NO.
P. O. OR REQ. NO.
AUTHORIZATION NO. 59-5T1000

SAMPLE OF Concrete fragments
FOR USE IN Concrete strength testing
SAMPLE FROM Bent 2, column 2
DEPTH Surface
LOCATION OF SOURCE Bridge # 39-160L Billy Wright Road I/C
THIS SAMPLE IS SHIPPED IN 1 (NO. CONTAINERS) AND IS ONE OF 1 SAMPLES REPRESENTING (TONS, GALS., SQLS., SYA., ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED
☐ NORMAL PRIORITY DATE NEEDED 5-9-01
REMARKS Core may require trimming to fit test machine.
COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 5-23-01
BY Arran Rambach TITLE TE
DIST., CO., RTE., P.M. 10-Ker-5-PM 16.72
LIMITS Test results to James Sagar 227-8246 of Structures Maintenance
CONT. NO. 1
FED. NO.
RES. ENGR. OR SUPT. Arran Rambach 227-7236
ADDRESS Send results to James Sagar of Structures
CONTRACTOR Maintenance

SAMPLER'S COPY

MAY 23 2001

CONCRETE CORE SAMPLE INFORMATION

EA No. 59-5T1000
SIC No. C-239184
Bridge No. Br # 39-160L
Dist. 10 Co. Ker Rte. 5
Date Rec'd. 5-23-01 P.M. PM 16.72
Sample No. 2, Spalled Concrete

Field No.	Core No. (2) Section	Corrosion No.
	2A	01-0519
	2B	-0520
	C	
	D	
	E	
	F	
	G	
	H	
	I	
	G	
	K	
	L	
	M	
	N	
	O	
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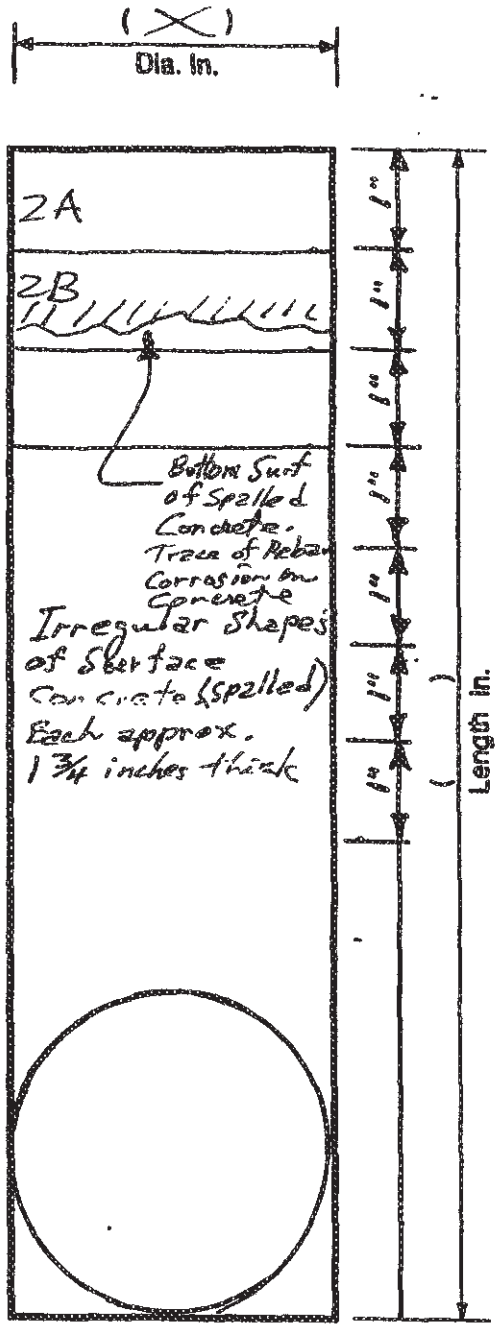
	W	
	X	
	Y	
	Z	



CA Department of Transportation

5900 Folsom Blvd., Sacramento, CA 95819

Phone: (916) 227-7295 Fax: (916) 227-7242

18-Jul-01

Sample Id No.	Sampled	Received	Approved	SMARA #	Sample of	District	E.A.	TL-101 #
01SOIL-00281	5/23/2001	5/23/2001			Soil	10	59-5T1000	C239187

GRADING ANALYSIS
Test Method CT 202

SIZE	% Passing
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
25 mm	100
19 mm	100
12.5 mm	100
9.5 mm	100
4.75 mm	100
2.36 mm	100
1.18 mm	
600 um	
300 um	
150 um	
75 um	
5 um	
1 um	

RELATIVE MORTAR STRENGTH
Test Method CT 515

Ratio

ORGANIC IMPURITIES
Test Method CT 213

Quality

Debris?

PLASTICITY INDEX
Test Method CT 204

LL PL

PI

LOS ANGELES RATTLER
Test Method CT 211

Grade

100 Revs

500 Revs

SAND EQUIVALENT
Test Method CT 217

Sand Equivalent

CLEANNESS VALUE
Test Method CT 227

63 x 37.5	25 x 4.75
37.5 x 19	12.5 max.
Pit run	Combined

DURABILITY INDEX
Test Method CT 229

Coarse Durability

Fine Durability

SPECIFIC GRAVITY
Test Method CT 206, CT 207, CT 208

Ret'd 4.75 mm	Passing 4.75 mm
SSD Spg	SSD Spg
Apparant	Apparant
Bulk OD	
% Absorption	% Absorption

Sample From:
Remote soil adjacent to Bent 2, Column 7
Location:
Br.# 39-160R

Depth: Surface

SODIUM SULFATE SOUNDNESS
Test Method CT 214

Type

Sieve Size	Individual % Loss
63 mm x 50 mm	
50 mm x 37.5 mm	
37.5 mm x 25 mm	
25 mm x 19 mm	
19 mm x 12.5 mm	
12.5 mm x 9.5 mm	
9.5 mm x 4.75 mm	

Weighted Avg loss of Sample

Fine Aggregate Loss

REMARKS : Sample processed and sent to Corrosion for CT 417, 422 and 643 on 5/31/01.

CA Department of Transportation

5900 Folsom Blvd., Sacramento, CA 95819

Phone: (916) 227-7295 Fax: (916) 227-7242

18-Jul-01

Sample Id No.	Sampled	Received	Approved	SMARA #	Sample of	District	E.A.	TL-101 #
01SOIL-00280	5/23/2001	5/23/2001			Soil	10	59-5T1000	C239186

GRADING ANALYSIS
Test Method CT 202

SIZE	% Passing
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
25 mm	100
19 mm	100
12.5 mm	100
9.5 mm	99
4.75 mm	97
2.36 mm	93
1.18 mm	
600 um	
300 um	
150 um	
75 um	
5 um	
1 um	

RELATIVE MORTAR STRENGTH
Test Method CT 515

Ratio

ORGANIC IMPURITIES
Test Method CT 213

Quality

Debris?

PLASTICITY INDEX
Test Method CT 204

LL PL

PI

LOS ANGELES RATTLER
Test Method CT 211

Grade

100 Revs

500 Revs

SAND EQUIVALENT
Test Method CT 217

Sand Equivalent

CLEANNESS VALUE
Test Method CT 227

63 x 37.5	25 x 4.75
37.5 x 19	12.5 max.
Pit run	Combined

DURABILITY INDEX
Test Method CT 229

Coarse Durability

Fine Durability

SPECIFIC GRAVITY
Test Method CT 206, CT 207, CT 208

Ret'd 4.75 mm	Passing 4.75 mm
SSD Spg	SSD Spg
Apparant	Apparant
Bulk OD	
% Absorption	% Absorption

Sample From:
Bent 2, Column 2

Location:
Br.# 39-160L

Depth: 24"

SODIUM SULFATE SOUNDNESS
Test Method CT 214

Type

Sieve Size	Individual % Loss
63 mm x 50 mm	
50 mm x 37.5 mm	
37.5 mm x 25 mm	
25 mm x 19 mm	
19 mm x 12.5 mm	
12.5 mm x 9.5 mm	
9.5 mm x 4.75 mm	
Weighted Avg loss of Sample	
Fine Aggregate Loss	

REMARKS : Sample processed and sent to Corrosion for CT 417, 422 and 643 on 5/31/01.

CA Department of Transportation

5900 Folsom Blvd., Sacramento, CA 95819

Phone: (916) 227-7295 Fax: (916) 227-7242

18-Jul-01

Sample Id No.	Sampled	Received	Approved	SMARA #	Sample of	District	E.A.	TL-101 #
01SOIL-00279	5/23/2001	5/23/2001			Soil	10	59-5T1000	C239185

GRADING ANALYSIS
Test Method CT 202

SIZE	% Passing
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
25 mm	100
19 mm	100
12.5 mm	100
9.5 mm	99
4.75 mm	99
2.36 mm	98
1.18 mm	
600 um	
300 um	
150 um	
75 um	
5 um	
1 um	

RELATIVE MORTAR STRENGTH
Test Method CT 515

Ratio

ORGANIC IMPURITIES
Test Method CT 213

Quality

Debris?

PLASTICITY INDEX
Test Method CT 204

LL PL

PI

LOS ANGELES RATTLER
Test Method CT 211

Grade

100 Revs

500 Revs

SAND EQUIVALENT
Test Method CT 217

Sand Equivalent

CLEANNESS VALUE
Test Method CT 227

63 x 37.5	25 x 4.75
37.5 x 19	12.5 max.
Pit run	Combined

DURABILITY INDEX
Test Method CT 229

Coarse Durability

Fine Durability

SPECIFIC GRAVITY
Test Method CT 206, CT 207, CT 208

Ret'd 4.75 mm	Passing 4.75 mm
SSD Spg	SSD Spg
Apparant	Apparant
Bulk OD	
% Absorption	% Absorption

Sample From:
Bent 2, Column 7

Location:
Br.# 39-160R

Depth: Surface

SODIUM SULFATE SOUNDNESS
Test Method CT 214

Type

Sieve Size	Individual % Loss
63 mm x 50 mm	
50 mm x 37.5 mm	
37.5 mm x 25 mm	
25 mm x 19 mm	
19 mm x 12.5 mm	
12.5 mm x 9.5 mm	
9.5 mm x 4.75 mm	

Weighted Avg loss of Sample

Fine Aggregate Loss

REMARKS : Sample processed and sent to Corrosion for CT 417, 422 and 643 on 5/31/01.

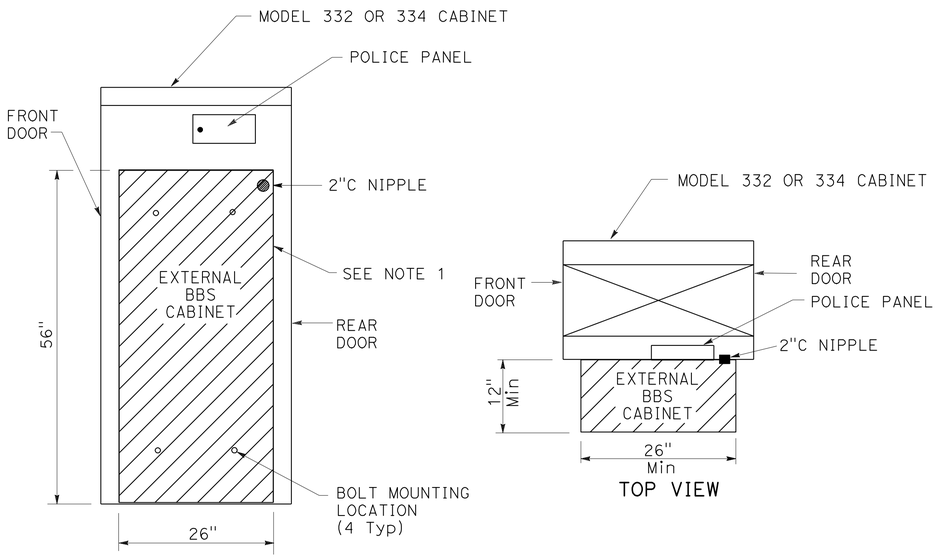
INSTALLATION DETAILS
FOR BATTERY BACKUP SYSTEM
(BBS Cabinet mounting details and wiring details)

Dist	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Theresa Gabriel — 12-20-07
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
Theresa A. Gabriel
No. E15129
Exp. 6-30-10
ELECT
STATE OF CALIFORNIA

PLANS APPROVAL DATE

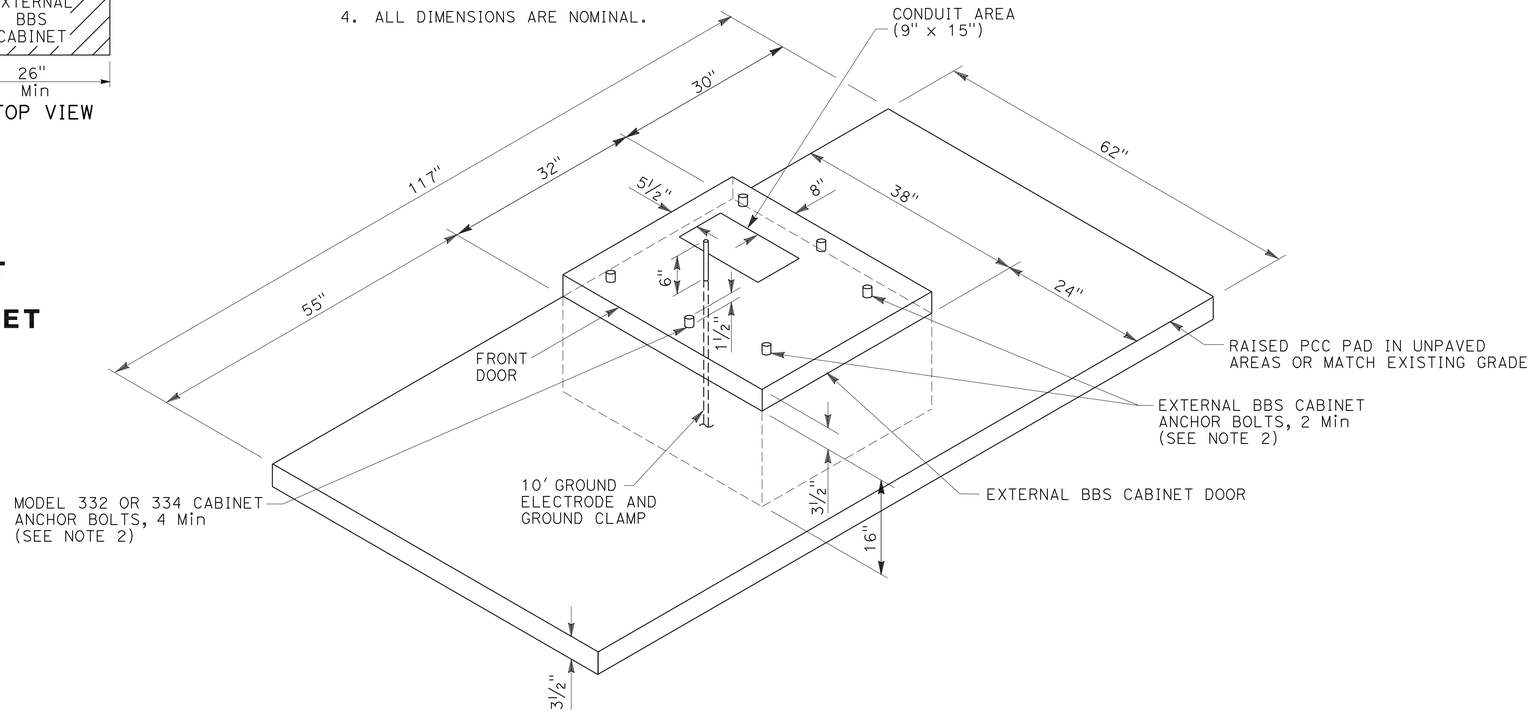


SIDE VIEW

EXTERNAL BBS CABINET MOUNTED TO THE MODEL 332 OR 334 CABINET

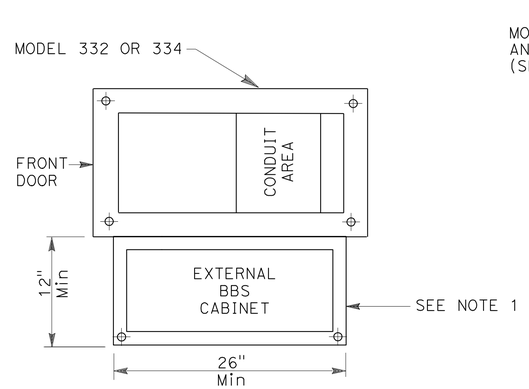
NOTE: (THIS SHEET ONLY)

1. THE EXTERNAL BBS CABINET SHALL BE MOUNTED TO THE MODEL 332 OR 334 CABINET WITH FOUR 18-8 STAINLESS STEEL HEX HEAD, FULLY-THREADED, $\frac{3}{8}$"-16 X 1" BOLTS; TWO WASHERS PER BOLT, DESIGNED FOR $\frac{3}{8}$" BOLTS AND ARE 18-8 STAINLESS STEEL, 1" OUTSIDE DIAMETER, ROUND, AND FLAT; AND ONE K-LOCK NUT PER BOLT THAT IS 18-8 STAINLESS STEEL AND A HEX-NUT. THE ENGINEER WILL HAVE TO APPROVE THE BOLT MOUNTING LOCATION PRIOR TO INSTALLATION.
2. THE ANCHOR BOLTS SHALL BE $\frac{3}{4}$" Dia X 15" WITH A 2"-90° BEND. THE CABINET MANUFACTURER'S SPECIFICATION SHALL DETERMINE THE LOCATION OF THE ANCHOR BOLTS IN THE FOUNDATION. THE ENGINEER WILL HAVE TO APPROVE THE ANCHOR BOLTS AND ITS LOCATION IN THE FOUNDATION PRIOR TO CONSTRUCTION.
3. THE CONTRACTOR SHALL VERIFY THE DIMENSIONS OF THE BBS CABINET PRIOR TO CONSTRUCTING THE FOUNDATION OF THE MODIFIED PORTION OF THE Std MODEL 332 AND 334 CABINET FOUNDATION. THE ENGINEER WILL HAVE TO APPROVE ANY NECESSARY DEVIATIONS PRIOR TO CONSTRUCTION.
4. ALL DIMENSIONS ARE NOMINAL.



MODIFIED MODEL 332 AND 334 CABINET FOUNDATION DETAIL FOR BATTERY BACKUP SYSTEM (BBS)

(FOR DIMENSIONS AND DETAILS NOT SHOWN AND ADDITIONAL NOTES, SEE SHEET ES-3C OF THE STANDARD PLANS FOR MODEL 332 AND 334 CABINETS)



BASE PLAN FOR BBS MOUNTED TO THE MODEL 332 OR 334 CABINET

(FOR DIMENSIONS AND DETAILS NOT SHOWN, SEE SHEET A6-1 TO A6-4, CABINET HOUSING DETAILS OF THE TRANSPORTATION ELECTRICAL EQUIPMENT SPECIFICATION (TEES))

ELECTRICAL SYSTEMS
(BBS FOUNDATION DETAILS)

NO SCALE

THIS PLAN IS ACCURATE FOR ELECTRICAL WORK ONLY.

REVISED BY | DATE REVISED
CALCULATED-DESIGNED BY | CHECKED BY
FUNCTIONAL SUPERVISOR
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LAST REVISION 2-2-09
DATE PLOTTED => 13-APR-2010
TIME PLOTTED => 11:41

BORDER LAST REVISED 4/11/2008
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
USERNAME => trpierce
DGN FILE => BBS Foundation.dgn
CU 00000
EA 000000

Dist	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Theresa Gabriel — REGISTERED CIVIL ENGINEER — 12-20-07 DATE

REGISTERED PROFESSIONAL ENGINEER — Theresa A. Gabriel — No. E15129 — Exp. 6-30-10 — ELECT — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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LEGEND: (THIS SHEET ONLY)

PTS = POWER TRANSFER SWITCH
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UPSC = UNINTERRUPTIBLE POWER SUPPLY CONTROLLER
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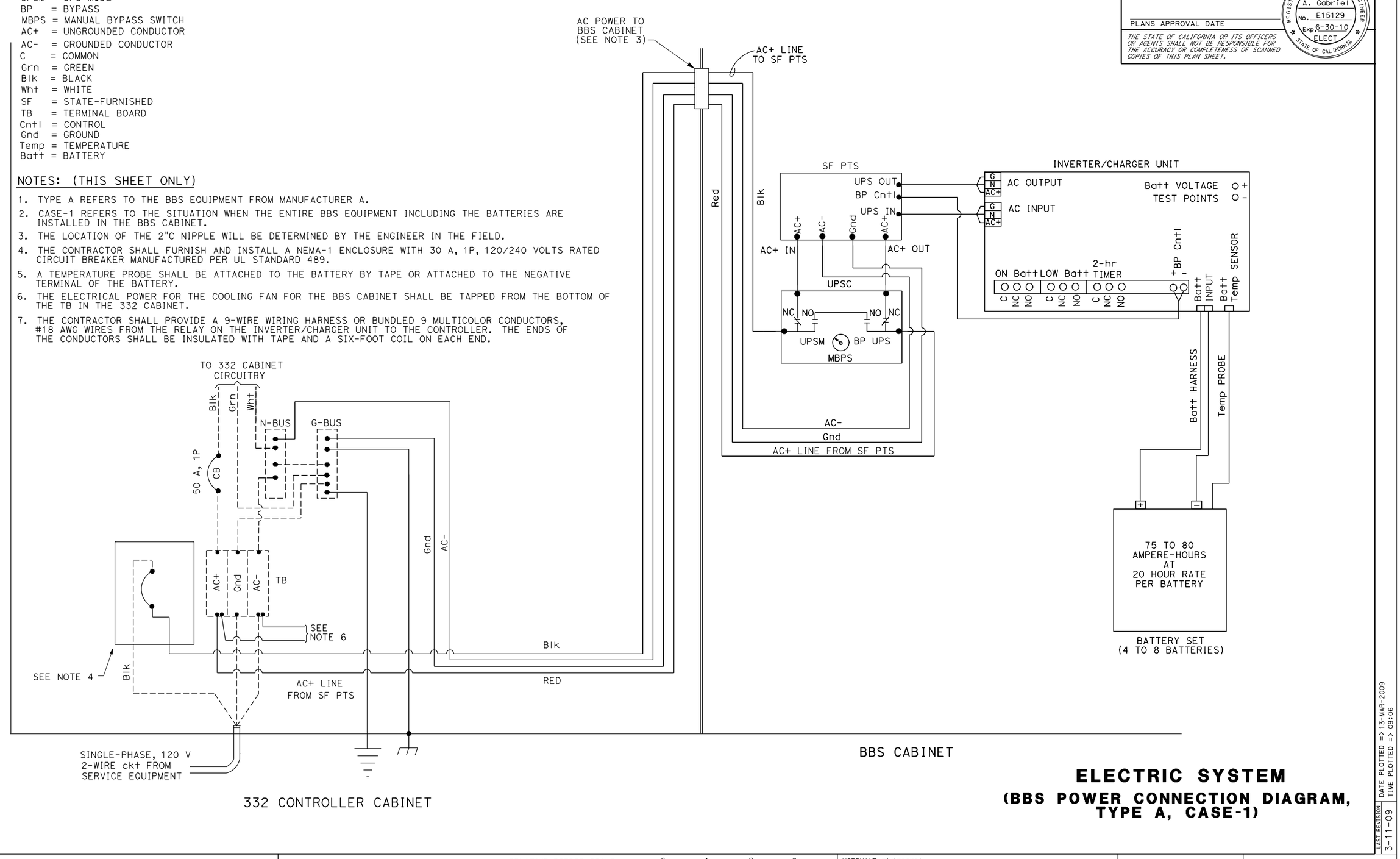
Grn = GREEN
Blk = BLACK
Wht = WHITE
SF = STATE-FURNISHED
TB = TERMINAL BOARD
Cntl = CONTROL
Gnd = GROUND
Temp = TEMPERATURE
Batt = BATTERY

NOTES: (THIS SHEET ONLY)

1. TYPE A REFERS TO THE BBS EQUIPMENT FROM MANUFACTURER A.
2. CASE-1 REFERS TO THE SITUATION WHEN THE ENTIRE BBS EQUIPMENT INCLUDING THE BATTERIES ARE INSTALLED IN THE BBS CABINET.
3. THE LOCATION OF THE 2"C NIPPLE WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.
4. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA-1 ENCLOSURE WITH 30 A, 1P, 120/240 VOLTS RATED CIRCUIT BREAKER MANUFACTURED PER UL STANDARD 489.
5. A TEMPERATURE PROBE SHALL BE ATTACHED TO THE BATTERY BY TAPE OR ATTACHED TO THE NEGATIVE TERMINAL OF THE BATTERY.
6. THE ELECTRICAL POWER FOR THE COOLING FAN FOR THE BBS CABINET SHALL BE TAPPED FROM THE BOTTOM OF THE TB IN THE 332 CABINET.
7. THE CONTRACTOR SHALL PROVIDE A 9-WIRE WIRING HARNESS OR BUNDLED 9 MULTICOLOR CONDUCTORS, #18 AWG WIRES FROM THE RELAY ON THE INVERTER/CHARGER UNIT TO THE CONTROLLER. THE ENDS OF THE CONDUCTORS SHALL BE INSULATED WITH TAPE AND A SIX-FOOT COIL ON EACH END.



ELECTRIC SYSTEM
(BBS POWER CONNECTION DIAGRAM, TYPE A, CASE-1)

LAST REVISION 3-11-09 | DATE PLOTTED => 13-MAR-2009 | TIME PLOTTED => 09:06

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | FUNCTIONAL SUPERVISOR | CALCULATED-DESIGNED BY | CHECKED BY | REVISED BY | DATE REVISED

BORDER LAST REVISED 4/11/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => trcarol | DGN FILE => BBS 1250FSM.dgn | CU 00000 | EA 000000

Dist	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Theresa Gabriel — REGISTERED CIVIL ENGINEER — 12-20-07 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Theresa A. Gabriel — No. E15129 — Exp 6-30-10 — ELECT — STATE OF CALIFORNIA

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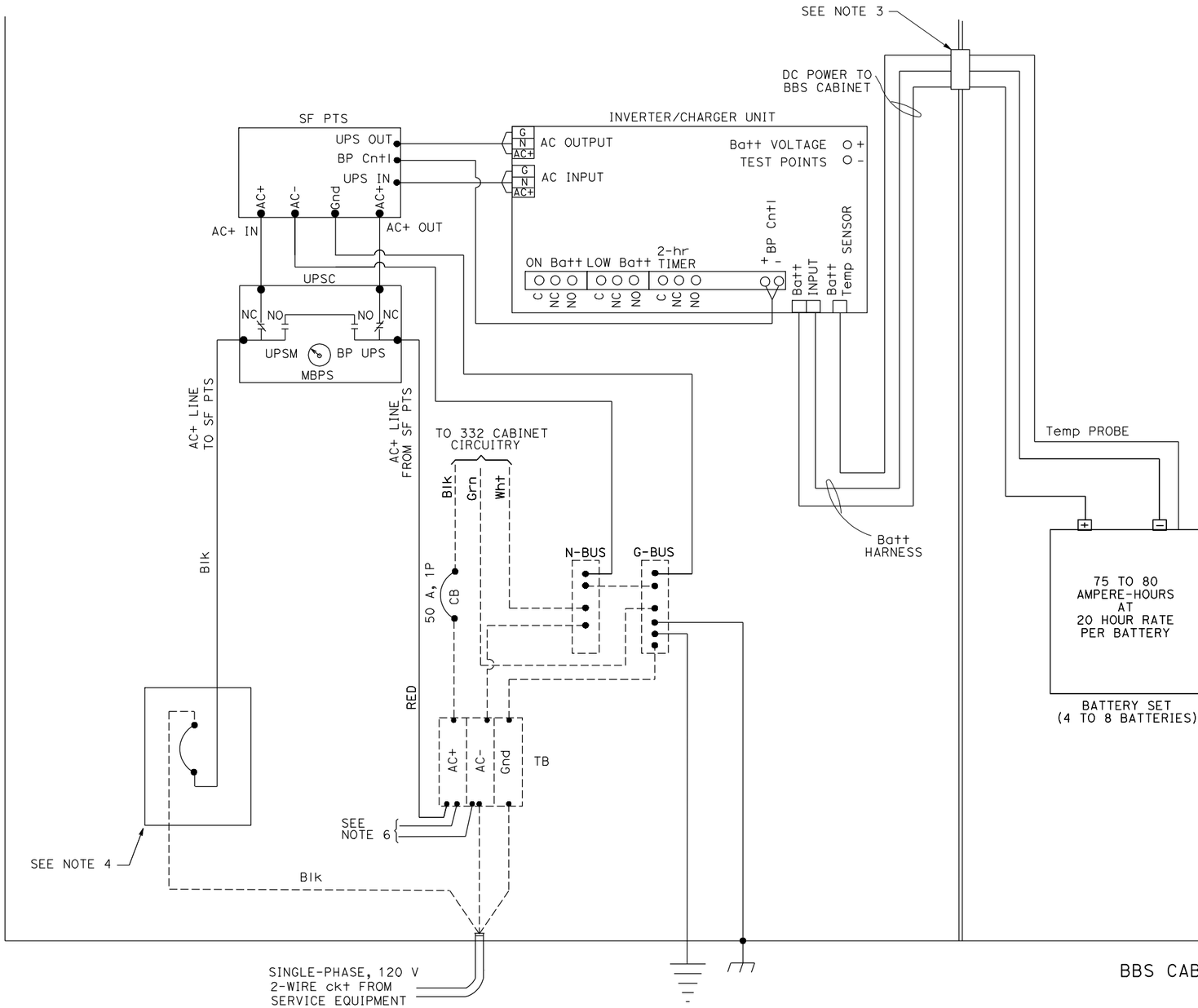

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Temp = TEMPERATURE
TB = TERMINAL BOARD
Cntl = CONTROL
Gnd = GROUND

NOTES: (THIS SHEET ONLY)

1. TYPE B REFERS TO THE BBS EQUIPMENT FROM MANUFACTURER B.
2. CASE-2 REFERS TO THE SITUATION WHEN ONLY THE BATTERIES ARE INSTALLED IN THE BBS CABINET. THE REMAINING EQUIPMENT IS PLACED IN THE 332 CONTROLLER CABINET.
3. THE LOCATION OF THE 2"C NIPPLE WILL BE DETERMINED BY THE ENGINEER IN THE FIELD.
4. THE CONTRACTOR SHALL FURNISH AND INSTALL A NEMA-1 ENCLOSURE WITH 30 A, 1P, 120/240 VOLTS RATED CIRCUIT BREAKER MANUFACTURED PER UL STANDARD 489.
5. A TEMPERATURE PROBE SHALL BE ATTACHED TO THE BATTERY BY TAPE OR ATTACHED TO THE NEGATIVE TERMINAL OF THE BATTERY.
6. THE ELECTRICAL POWER FOR THE COOLING FAN FOR THE BBS CABINET SHALL BE TAPPED FROM THE BOTTOM OF THE TB IN THE 332 CABINET.
7. THE CONTRACTOR SHALL PROVIDE A 9-WIRE WIRING HARNESS OR BUNDLED 9 MULTICOLOR CONDUCTORS, #18 AWG WIRES FROM THE RELAY ON THE INVERTER/CHARGER UNIT TO THE CONTROLLER. THE ENDS OFTHE CONDUCTORS SHALL BE INSULATED WITH TAPE AND A SIX-FOOT COIL ON EACH END.

ELECTRICAL SYSTEMS
(BBS POWER CONNECTION DIAGRAM, TYPE A, CASE-2)

NO SCALE

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LAST REVISION 2-2-09
DATE PLOTTED => 13-MAR-2009
TIME PLOTTED => 09:07

Dist	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Theresa Gabriel — REGISTERED CIVIL ENGINEER — 12-20-07 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Theresa A. Gabriel — No. E15129 — Exp 6-30-10 — ELECT — STATE OF CALIFORNIA

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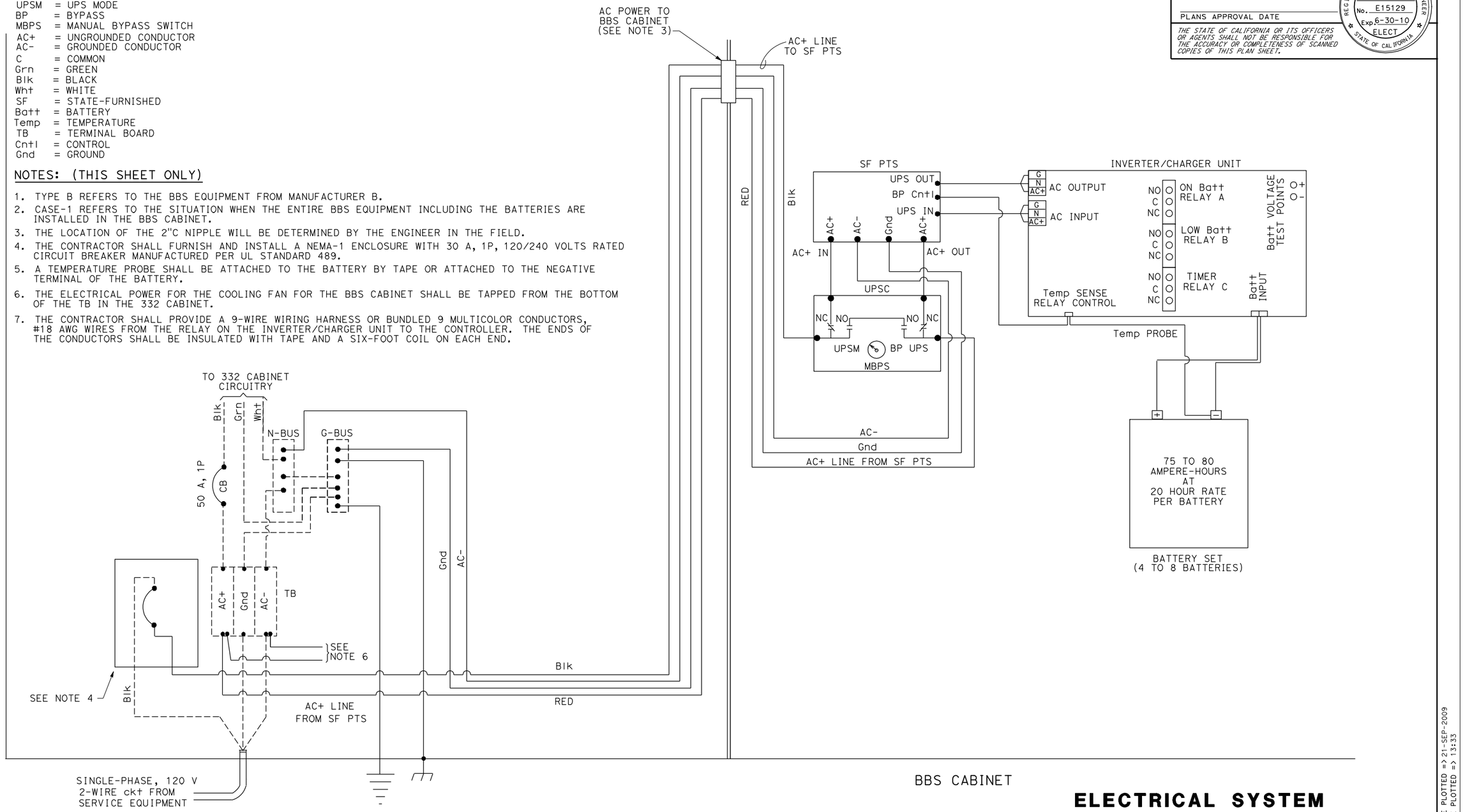

ELECTRICAL SYSTEM

(BBS POWER CONNECTION DIAGRAM, TYPE B, CASE-1)

LAST REVISION 3-11-09
DATE PLOTTED => 21-SEP-2009
TIME PLOTTED => 13:33

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BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => trcarol
DGN FILE => BBS DUIFSM.dgn

CU 00000

EA 000000

Dist	COUNTY	LOCATION CODE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Theresa Gabriel — 12-20-07
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Theresa A. Gabriel — No. E15129 — Exp 6-30-10 — ELECT — STATE OF CALIFORNIA

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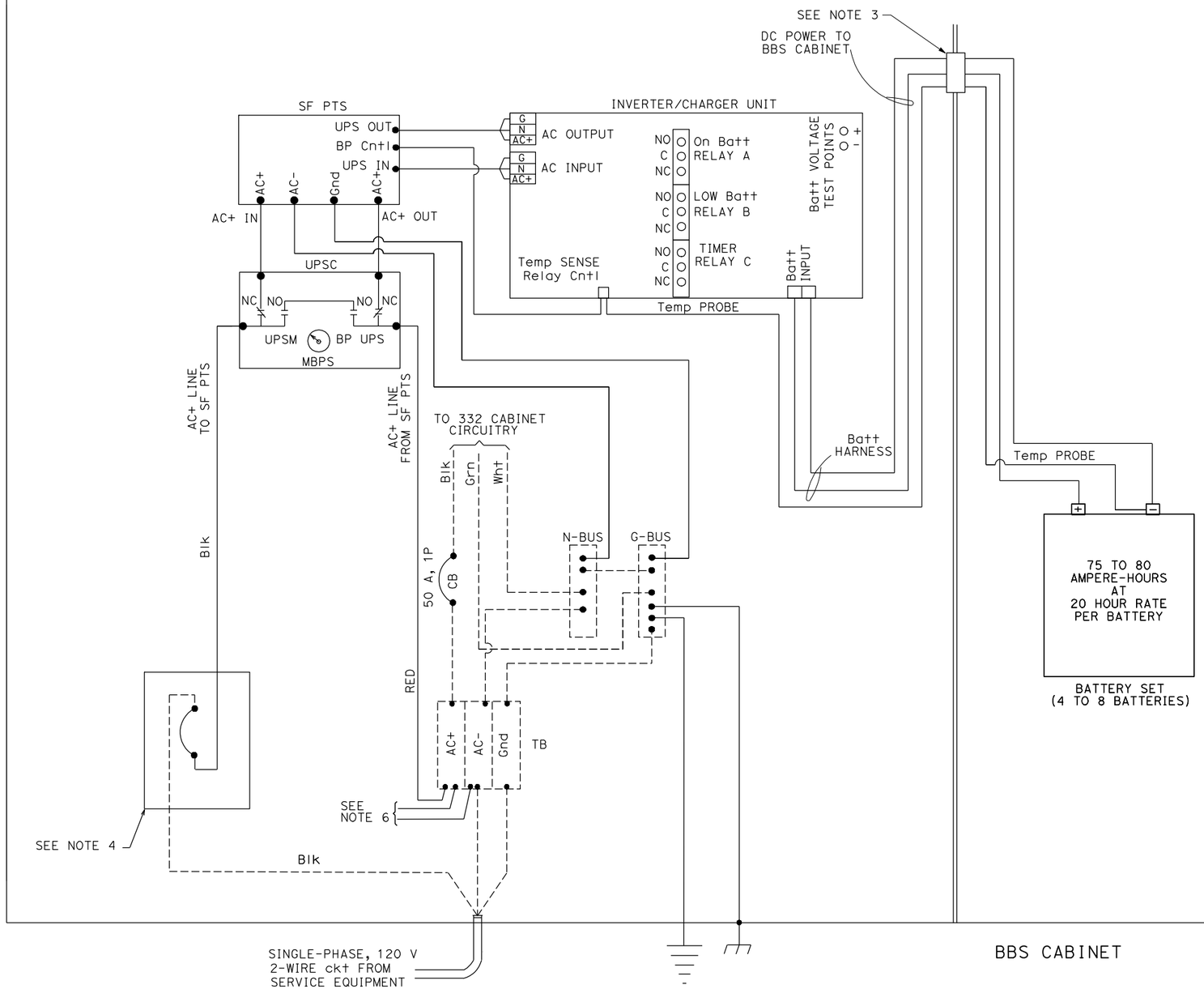

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ELECTRICAL SYSTEM

(BBS POWER CONNECTION DIAGRAM, TYPE B, CASE-2)

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USERNAME => trcarol
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CU 00000
EA 000000