

three inches = one foot
one and one half inches = one foot
one inch = one foot
three quarters inch = one foot
one half inch = one foot
three eighths inch = one foot
one quarter inch = one foot
one eighth inch = one foot

ONE-LINE LEGEND

- EXISTING TO REMAIN
NEW WORK - POWER & SENSING
NEW WORK - SIGNAL & COMMUNICATION
CIRCUIT TAG

SEQUENCE OF OPERATION

- GENERAL**
- THE ACCOMPANYING DIAGRAM IS A REDUCED ONE-LINE DIAGRAM TO ILLUSTRATE PROTECTIVE RELAYING OPERATION ONLY. SEE SHEETS 225-EP3.0 AND 225-EP3.1 FOR MORE COMPLETE SYSTEM ONE-LINES.
- NORMAL OPERATION**
- NORMAL OPERATION OF SYSTEM IS COGEN UNIT OPERATING PARALLEL A HOT UTILITY SOURCE.
- LOSS OF UTILITY**
- PROTECTIVE RELAYS 'INC1' AND 'INC2' SHALL BE USED TO SENSE LOSS OF THE UTILITY SUPPLY TO THE CAMPUS OR OTHER ABNORMAL CONDITIONS AS DESCRIBED BELOW.

- RELAY FUNCTIONS TO BE IMPLEMENTED INCLUDE THE FOLLOWING. NUMBERS IN PARENTHESES REFER TO ANSI/IEEE DEVICE NUMBERS.
- UNDER-VOLTAGE (27) W/ TWO STEPS OF PICKUP *
OVER-VOLTAGE (59) W/ TWO STEPS OF PICKUP *
UNDER-FREQUENCY (81U)
OVER-FREQUENCY (81O)
REVERSE POWER (32) *
DIRECTIONAL GROUND OVERCURRENT (67N)
* INDICATES PER PHASE SENSING IS REQUIRED

- ALL SETTINGS SHALL CONFORM TO THE REQUIREMENTS OF ONCOR ELECTRIC, THE SERVING UTILITY COMPANY. CONTRACTOR SHALL PROVIDE PLACARDS AT THE ONCOR METERING LOCATION TO MEET THE CLASS 3 REQUIREMENTS DESCRIBED IN THEIR DOCUMENT TITLED "ONCOR PLACARD GUIDELINE."
- BREAKERS 'UTIL1' & 'UTIL2' ARE ELECTRICALLY INTERLOCKED TO PRECLUDE THEIR SIMULTANEOUS CLOSING. AUXILIARY BREAKER POSITION CONTACTS IN BREAKERS 'UTIL1' & 'UTIL2' SHALL BE USED TO DETERMINE WHICH OF THE TWO INCOMING UTILITY SOURCES IS CURRENTLY FEEDING THE CAMPUS AND BEING OPERATED IN PARALLEL WITH THE COGEN UNIT. TRIP SIGNALS TO THE COGEN FEEDER BREAKERS 'CG1' & 'CG2' SHALL ORIGINATE FROM THE RELAY ('INC1' OR 'INC2') CORRESPONDING TO THE CURRENTLY ACTIVE FEED.
- UPON DETECTION OF MANDATORY TRIP CONDITIONS THE FOLLOWING SHALL OCCUR. A TRIP SIGNAL FROM THE ACTIVE UTILITY SUPPLY RELAY ('INC1' OR 'INC2') SHALL BE SENT TO BREAKER 'CG1'.
- POSITION SWITCHES IN SHALL BE PROVIDED IN BREAKER 'CG1' TO MONITOR FOR A SUCCESSFUL TRIP. IF AFTER THE EXPIRATION OF A ONE SECOND DELAY A TRIP OF BREAKER 'CG1' HAS NOT BEEN SENSED BY THE INCOMING SOURCE RELAY, A BACKUP TRIP SIGNAL SHALL BE SENT TO BREAKER 'CG2'.

- ABNORMAL CONDITIONS OF TURBINE GENERATOR**
- THE CONTRACTOR SHALL ALSO CONNECT TRIP SIGNALS FROM DRY CONTACTS PROVIDED IN THE TURBINE/GENERATOR CONTROL CONSOLE BY ITS MANUFACTURER. SETTINGS FOR THE PROTECTIVE TRIP SIGNAL FROM THE CONTROL CONSOLE SHALL BE AS PROGRAMMED BY THE TURBINE/GENERATOR MANUFACTURER.

- IF AFTER THE EXPIRATION OF A ONE SECOND DELAY A TRIP OF BREAKER 'CG1' HAS NOT BEEN SENSED IN RESPONSE TO THE TRIP SIGNAL FROM THE TURBINE GENERATOR, THE TURBINE/GENERATOR CONTROL PANEL SHALL SEND A BACKUP TRIP SIGNAL TO BREAKER 'CG2'.

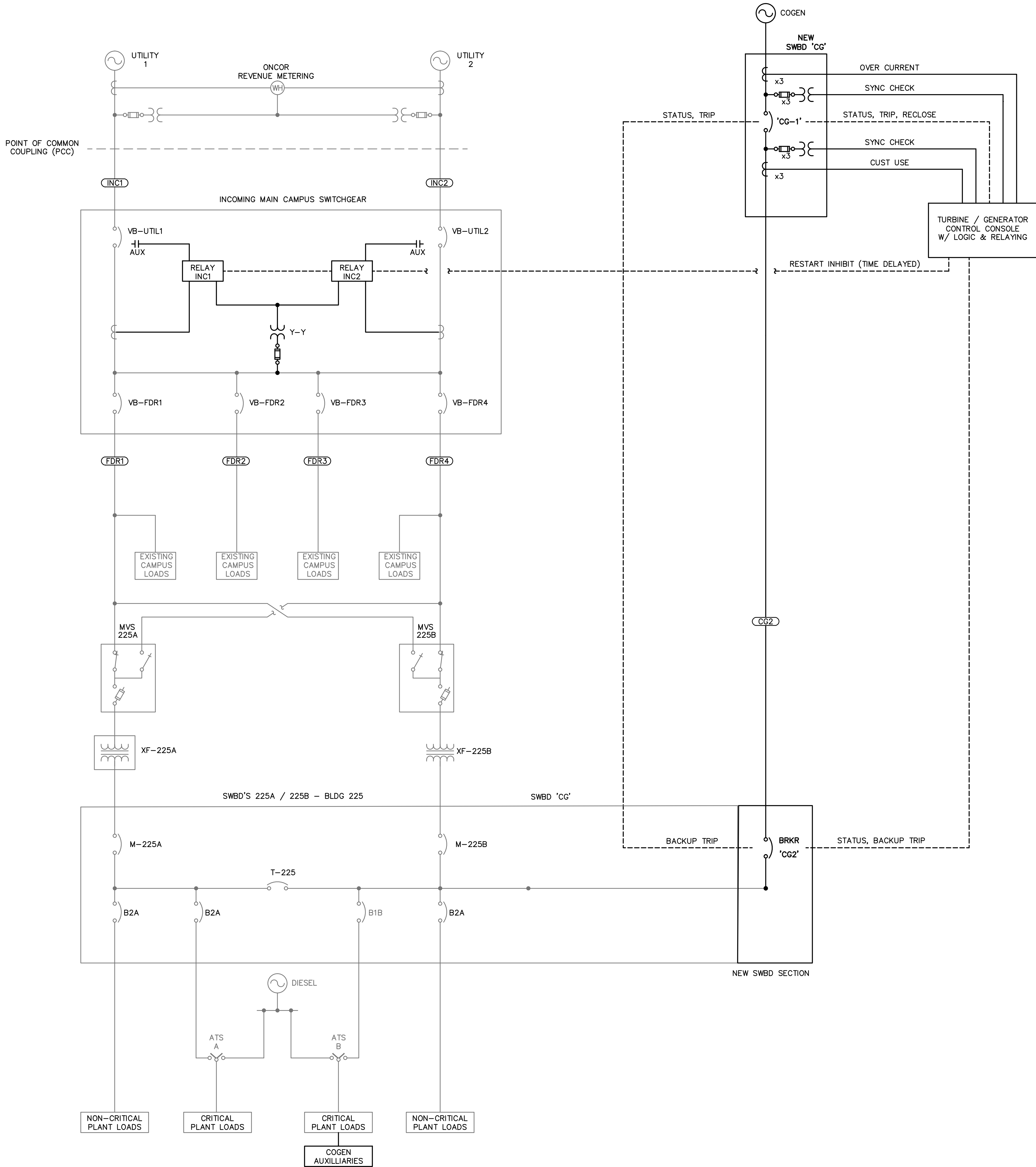
- DURING UTILITY OUTAGE PERIOD AND RESTORATION**
- THE TURBINE/GENERATOR SHALL REMAIN INOPERATIVE FOR THE DURATION OF THE OUTAGE.
 - AFTER RESTORATION OF THE UTILITY SOURCE A DELAY PERIOD OF 15 MINUTES SHALL BEGIN DURING WHICH TURBINE RESTART SHALL BE INHIBITED.
 - IF A BACKUP TRIP OF BREAKER 'CG2' HAS OCCURRED, AFTER INVESTIGATING AND CLEARING THE CAUSE OF FAILURE OF BREAKER 'CG1' TO TRIP, BREAKER 'CG2' MUST BE MANUALLY RECLOSED.
 - AFTER EXPIRATION OF THE RESTART INHIBIT TIME DELAY, THE TURBINE CAN BE MANUALLY RESTARTED. AFTER RESTARTING AND NECESSARY CONDITIONS DETERMINED BY THE TURBINE/GENERATOR MANUFACTURER'S SOFTWARE HAVE BEEN MET, THE TURBINE/GENERATOR CONTROL CONSOLE WILL BEGIN A SYNCHRONIZATION CHECK AND SEND A RECLOSE SIGNAL TO BREAKER 'CG1'.

MODIFICATIONS TO EXISTING MAIN CAMPUS SWITCHGEAR

- GENERAL**
- THE EXISTING SWITCHGEAR IS GENERAL ELECTRIC 'MAGNA-BLAST' TYPE MANUFACTURED IN 1971. THE OWNER HAS SHOP DRAWINGS ON FILE FOR THIS EQUIPMENT WHICH WILL BE MADE AVAILABLE TO THE CONTRACTOR. THE CONTRACTOR SHALL VERIFY THE ACCURACY AND ADEQUACY OF THE DRAWINGS BEFORE BEGINNING MODIFICATIONS.
 - THE ORIGINAL BREAKERS HAVE BEEN REPLACED WITH POWELL ELECTRIC 'POWL-VAC' REPLACEMENT BREAKERS, 15KV, 18KA WITH 48VDC TRIP & ACCESSORY CIRCUITS.
- MODIFICATIONS**
- EXISTING PT'S ARE 12,000 TO 120V CONNECTED IN OPEN DELTA (2 PT'S). PT'S ARE LOCATED IN UNIT 5B. REMOVE EXISTING PT'S AND REPLACE WITH (3) NEW 100:1 RATIO Y-Y CONNECTED PT'S SO AS TO MATCH PREVIOUS LINE TO LINE OUTPUT VOLTAGES, ROTATION AND PHASE ANGLES.
 - REMOVE EXISTING INDICATING AMMETERS ASSOCIATED WITH EACH OF THE SIX EXISTING BREAKERS AND REPLACE WITH YOKOGAWA CAT. NO. 249115, OR EQUAL METERS. REPLACE EXISTING POTENTIAL BUS VOLT/METER IN UNIT 5 WITH A YOKOGAWA CAT. NO. 249125, OR EQUAL VOLT/METER.
 - INSTALL NEW SEL 351-7 RELAYS AS INDICATED. CONNECT TO EXISTING CT CIRCUITS AND EXISTING POTENTIAL BUS (FED BY NEW PT'S AS SHOWN). PROVIDE A RESIDUAL GROUND TYPE TO THE RELAYS.

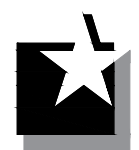
COMMUNICATIONS

- ALL COMMUNICATION BETWEEN THE RELAYS AND REMOTE LOCATIONS SHALL BE BY FIBER OPTIC. COMMUNICATIONS UTILIZING MIRRORRED BIT COMMUNICATION. FIBER OPTIC CABLES SHALL BE 62.5 μ M MULTI-MODE WITH TYPE ST CONNECTORS. SEL-C807G04. CONTRACTOR SHALL DETERMINE LENGTHS REQUIRED AND ORDER CABLE PRE-TERMINATED, INCLUDING A MINIMUM OF 25' EXCESS AT EACH TERMINATION POINT (EXCEPTING SHORT JUMPERS LOCATED WITHIN THE SAME EQUIPMENT IF REQUIRED).
- UTILIZE SEL-2505 REMOTE I/O MODULES AT SITE MAIN SWITCHGEAR, BRKR 'CG2', BRKR 'CG1', AND TURBINE GENERATOR CONTROL CONSOLE TO PROVIDE REQUIRED INTERCOMMUNICATION BETWEEN THESE LOCATIONS.
- UTILIZE EXISTING STATION BATTERIES AT MAIN SITE SWITCHGEAR TO POWER THE I/O MODULE AT THIS LOCATION. UTILIZE NEW STATION BATTERIES AT BRKR 'CG2' TO POWER ITS I/O MODULE AND TRIPPING VOLTAGE, THE I/O MODULE LOCATED AT BRKR 'CG1' AND ITS TRIPPING VOLTAGE, AND THE I/O MODULE LOCATED AT THE TURBINE CONTROL CONSOLE. EXTEND 2#6, #10G FROM THE BREAKER 'CG2' LOCATION TO THE REMAINING LOCATIONS IN BUILDING 225.



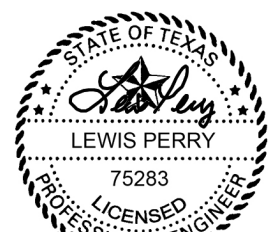
SCHEMATIC DESIGN SUBMISSION	
DESIGN DEVELOPMENT SUBMISSION	
CONSTRUCTION DOCUMENT SUBMISSION	
ISSUED FOR BIDS	
AMMENDMENT #1	08-16-13
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STRUCTURAL ENGINEERS
CIVIL ENGINEERS
COMMISSIONING

O'CONNELL ROBERTSON
360° ENGINEERING, INC.
BELTON ENGINEERING, INC.
CCRD

Drawing Title

PROTECTIVE RELAYING

Approved Project Director

Project Title

INSTALL CO-GEN SYSTEM

Location

WACO, TEXAS

Date

5/24/13

Checked

L.P.

Drawn

R.S.

Drawing Number

225-EP3.2

ISSUE FOR BID

FULLY SPRINKLERED

Office of
Construction
and Facilities
Management



Department of
Veterans Affairs