TVA 10697 (DNE 6-86) DNE CALCULATIONS **QA RECORD** SHEET i / 83

TITLE	PLANT/UNIT
CENTER OF GRAVITY FOR JB'S 7193 & 7196	BFN U2

PREPARING ORGANIZATION	KEY NOUNS (Consult RIMS DESCRIPTORS LIST)
BFEPCI EMG BNAPC R1	BREAKER REPLACEMENT, CENTER OF GRAVITY, JUNCTION BOXES R1

BRANCH/PROJECT IDENTIFIERS	Rev	(for RIMS' use)	RIMS accession number
~~BFEPC10582~~ R1 CD-Q2253-883859		Each time these calculations are issued, preparers must ensure that the original (RO) RIMS accession number is filled in.	
	R0	870529B0023 (9)	B22 '87 0512 ~~102~~ 120
APPLICABLE DESIGN DOCUMENT(S) QIR-CEB-86-086	R1	880810D0020 (11)	B22 '88 0806 103
	R2	881019C0012 (12)	B22 '88 1016 156
SAR SECTION(S) N/A; UNID SYSTEM(S) 253 R1	R3		B22 '89 1216 126

	Revision 0	R1	R2	R3
ECN No. (or indicate Not Applicable)	P0399	P0399	F2304A	W6816A & W6841A
Prepared	Thomas H. Hayes	7-14-88 [signature]	9-26-88 [signature]	10/23/89 K. Wong
Checked	[signature]	[signature] 7/15/88	[signature] 9-26-88	10-25-89 [signature]
Reviewed	[signature]	[signature]	[signature]	[signature]
Approved	C. N. Simmons	[signature]	[signature]	[signature] J. R. Rupert
Date	5-8-87	7/18/88	9/28/88	12/01/89
List all pages added by this revision.		iii, iv	NONE	8
List all pages deleted by this revision.		NONE	NONE	NONE
List all pages changed by this revision.		i, ii, 1, 5, 6, 7	ii, 1, 5, 6, 7	i, ii, iii, iv, 1, 2, 3, 4, 5

Use form TVA 10534 if more space required.

Safety-related? Yes ☒ No ☐

Statement of Problem

The center of gravity for JB'S 7193 & 7196 needs to be determined.

ORIGINAL

Legibility evaluated and accepted for issue. Sheet i thru Sheet 8

[signature] 12-16-89

Signature for J. Rupert Date

Abstract

These calculations contain an unverified assumption(s) that must be verified later. Yes ☐ No ☒

The center of gravity was approximated. It was shown on figure 1 page 4.

THIS REVISION 1 IS DUE TO THE REPLACEMENT OF THE BREAKERS INSIDE THE JB'S 7193 & 7196. | R1

THIS REVISION 2 IS TO DELETE ONE OF THE EXISTING BREAKERS INSIDE THE JB'S 7193 & 7196 | R2

THIS REVISION 3 IS TO ADD ONE BREAKER INSIDE THE JB'S 7193 & 7196 CHANGE IN DIMENSIONS FOR THE OVERALL CENTER OF GRAVITY IS INSIGNIFICANT | R3

DIRECT DESIGN INPUT

ENGINEERING RECORDS PROCESSING
CALCULATION CONTROL
ANNEX C BFN
~~CALCULATION LIBRARY~~

☐ Microfilm and store calculations in RIMS Service Center. Microfilm and destroy. ☐

☒ Microfilm and return calculations to: ~~BFCA~~ NES ~~EDB F3 BFN~~ Address: ~~F41 EDB BFN~~ JE 12-16-89

TVA

SHEET 1 OF 2

REVISION LOG
CDQ2253-883859
~~BFEPC10582~~

Title: Center of Gravity for JB's 7193 & 7196

Revision No.	DESCRIPTION OF REVISION	Date Approved
1	ISSUED FOR ECN NO. P-0399 ~~Rev 0~~	7/18/8.
2	ISSUED FOR FDCN NO. F2304 A (DELETE ON BREAKER IN JB 7193 & 7196)	9/28/88
3	ISSUED FOR DCN W6816B & W6841B (ADDITION OF BREAKER TO JB's 7193 & 7196)	12/02/89

TVA 10534 (EN DES-4-78)

SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.
i	13												
ii	13												
iii	13												
iv	13												
1	23												
2	13												
3	13												
4	13												
5	23												
6	23												
7	23												
8	3												

REVISION STATUS SHEET

CENTER OF GRAVITY FOR JB's 7193 & 7196

JOB NO. 19106

CALCULATION NO. CD-Q2253-883857

REV. NO. 3

SEPC-10078 S

CALCULATION SHEET

BECHTEL

BEPC-2706 Rev. 6/84 (ED-491

JOB NO.	CALC. NO.	REV. NO.	SHEET NO.
19106	CD-Q2253-883859	3 *	IV

ORIGINATOR	DATE	CHECKED	DATE
[signature]	7-13-88	[signature]	7-15-88

SUBJECT CENTER OF GRAVITY FOR JUNCTION BOXES 7193, 7194

Revs	Originator	Date	Checked	Date
3	[illegible]	10/23/89	[illegible]	10/23/89

TABLE OF CONTENTS

TOTAL NUMBER OF SHEETS: 12 /R3

CD-Q2253-883859 | R1
~~DEFECTIVE~~ PAGE 1
CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196
ECN P0399

SHEET 1 OF 37
ORIGINATOR: Alan Lotto 7-14-88 REV 3
CHECKED: [illegible] 7-15-88 R3
COMPUTED [illegible] DATE 4/30/87
CHECKED [illegible] DATE 5/1/87

Rev:	Origin	Date	Chkd.	Date
2	AL	9-26-88	[illegible]	9-26-88

Rev:	Origin	Date	Chkd.	Date
3	[illegible]	10/27/89	A. [illegible]	10/25/89

Purpose:

The junction boxes (7193 & 7196) shown on TVA drawings 45W326B and 45W327B need center of gravity dimensions. (SEE * BELOW) R3.

R2 Evaluation: ~~BREAKER NO 3 WILL BE DELETED PER REV. 2 ; BUT FOR CONSERVATISM THE C AND TOTAL WT. OF BOX + CONTENTS WILL BE BASED ON 4 BREAKERS, THEREFORE THE FOLLOWING CALC. IS STILL VALID .~~

Weights and overall dimensions are given in Figure 1-5 and Table 1. This information was provided by EEB.

Assume Cg of Hoffman Box is at the geometric center of the box.

$R_B = 2.0$ ft $\quad W_B = 148$ lbs
$T_B = 0.5$ ft
$S_B = 1.5$ ft

Assume Cg of inner panel is as below;

$R_p = 2.0$ ft $\quad W_p = 49$ lb
$T_p = 1$ inch
$S_p = 1\frac{1}{2}$ ft

Assume Cg of each switch/Breaker is at its geometric center

* R3: ADD ITEM (3), GE 600 CIRCUIT BREAKER GE PART # TJH36 (TVA MARK # BJ2-4) AND THE REVISION OF TWO DIMENSIONS. SINCE THE CALCULATION IS BASED ON 4 BREAKERS AND THERE IS NO CHANGE IN TOTAL HEIGHT OF BOX AND CONTENTS. ALSO THE CHANGE IN DIMENSIONS ARE INSIGNIFICANT. THEREFORE, THE DIFFERENCES IN CENTRE GRAVITY IS INSIGNIFICANT.

CD-Q2253-109857 | 1-1
~~EFEC10582~~ PAGE 2
CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196
ECN P0399

SHEET 2 OF (X81R. REV 3)
ORIGINATOR: Alma Indo 7-14-88
CHECKED: A Butic 7-15-88
COMPUTED DJD DATE 4/30/87
CHECKED A.U/BJB DATE 5/1/87

Breaker 1

$R_{B1} = (\cancel{8.5} + 15.12 + \cancel{9.7085}) + \frac{10.125}{2}$ (8.5, 16.12, 7.093 | R3)

$= (35.89 \rightarrow 36.78)$ inches | R3

$W_{B1} = 12$ lb

Rev:	Origin	Date
3	Chkd.	Date 10/25/89

$S_{B1} = 10.05 + 15.75$

$= 25.8$ "

$T_{B1} = 1 + \frac{3.81}{2}$

$= 2.91$ "

Breaker 2

$R_{B2} = R_{B1} = (35.89 \rightarrow 36.78")$ | R3 $W_{B2} = 12$ lb

$S_{B2} = 10.05$ "

$T_{B2} = T_{B1} = 2.91$ "

Breaker 3

$R_{B3} = (\cancel{8.5} + \frac{13.75 + 1.19(2)}{2})$ (8.5 | R3)

$= (14.07 \rightarrow 16.56")$ | R3 $W_{B3} = 50$ lb

$S_{B3} = S_{B1} = 25.8$ "

$T_{B3} = 1 + (\frac{\cancel{4.81}}{2} \rightarrow \frac{3.8125"}{2})$ | R3

$= (3.46" \rightarrow 2.91")$ | R3

Breaker 4

$R_{B4} = R_{B3} =$ (~~14.07~~" 16.56") /R3 $W_{B4} =$ 50 lb

Rev.	Origin [signature] Date 10/23/89
3	Chkd. [signature] Date 10/25/89

$S_{B4} = S_{B2} = 10.05''$

$T_{B4} = T_{B3} =$ (~~3.16~~" 2.19") /R3

OVERALL CG

$W_T = 148 + 49 + 12 + 12 + 50 + 50$

$= 321$ lbs

$R_T = [(24)(148) + (24)(49) + ($~~35.89~~ 36.78$)(12) + ($~~35.89~~ 36.78$)(12) +$ /R3

$($~~14.07~~ 16.56$)(50) + ($~~14.07~~ 16.56$)(50)] \frac{1}{321}$ /R3

$=$ (~~21.8~~" 22.64") /R3

$S_T = [18(148+49) + 25.8(12+50) + 10.05(12+50)] \frac{1}{321}$

$= 17.97''$
Say 18"

$T_T = [(6)(148) + (1)(49) + (2.91)(24) + ($~~3.16~~ 2.91$)(100)] \frac{1}{321}$ /R3

$=$ (~~4.1~~" 4.0") /R3

Conclusion:

OVERALL CG IS SHOWN ON FIGURE 1. THE CHANGES ARE INSIGNIFICANT. /R3

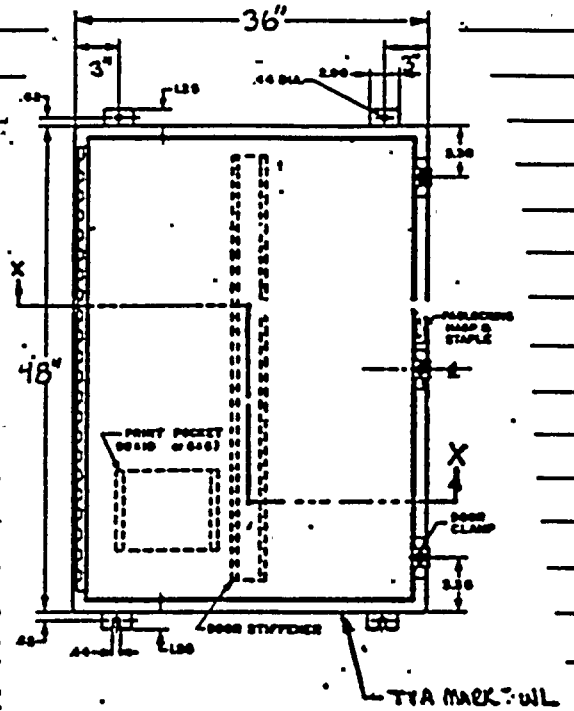
CD-Q2253-883859 / K-1
~~BFEFG10SE2~~ PAGE 4/7
CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196
ECN P0399

ORIGINATOR: [illegible] 7-14-88 SHT 4 OF 18 REV 3
CHECKED: [illegible] 7-15-88 /R3

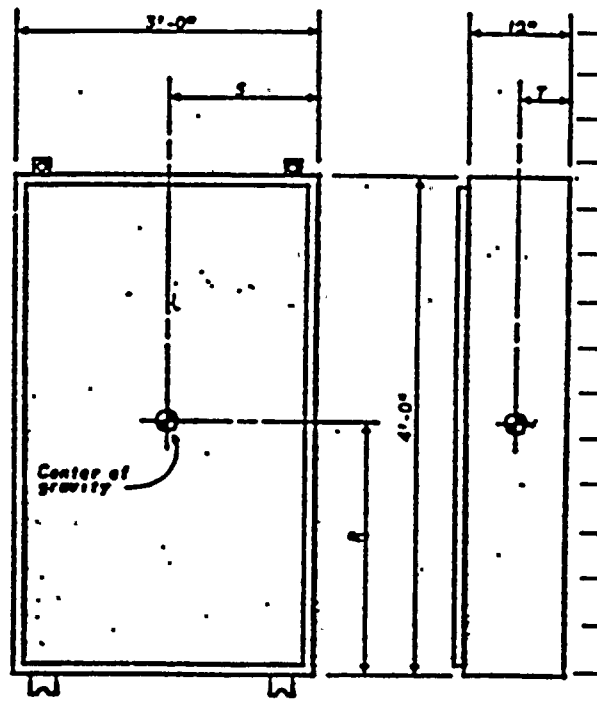
COMPUTED DATE

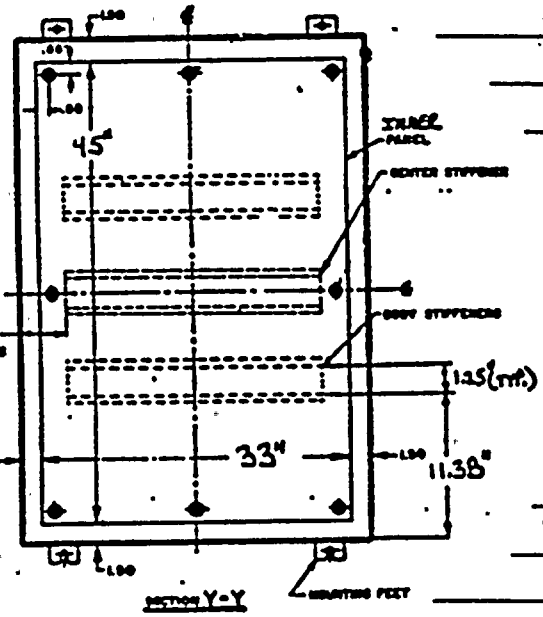
CHECKED DATE

Revs	Origin ~~K. Wong~~ Date ~~10/23/89~~
3	Chkd. A. Shit Date 10/25/89



FRONT ELEVATION VIEW
CIRCUIT BREAKER BOX (TYP.)





JB 719
R = ~~21.8"~~ 22.64" /R3
S = 18.0"
T = ~~4.1~~ 4.0"

Figure 1

INNER PANEL ORIENTATION

ALL INTERNAL DEVICES MOUNT ON INNER PANEL

~~ELECTRICAL~~ PAGE 3/1
CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196.
ECN P0399

IO

ORIGINATOR: [illegible] 7-14-88 REV. X3
CHECKED: A Burtic 7-15-88
COMPUTED _____ DATE _____ SHT 5 OF 18 R3
CHECKED _____ DATE _____

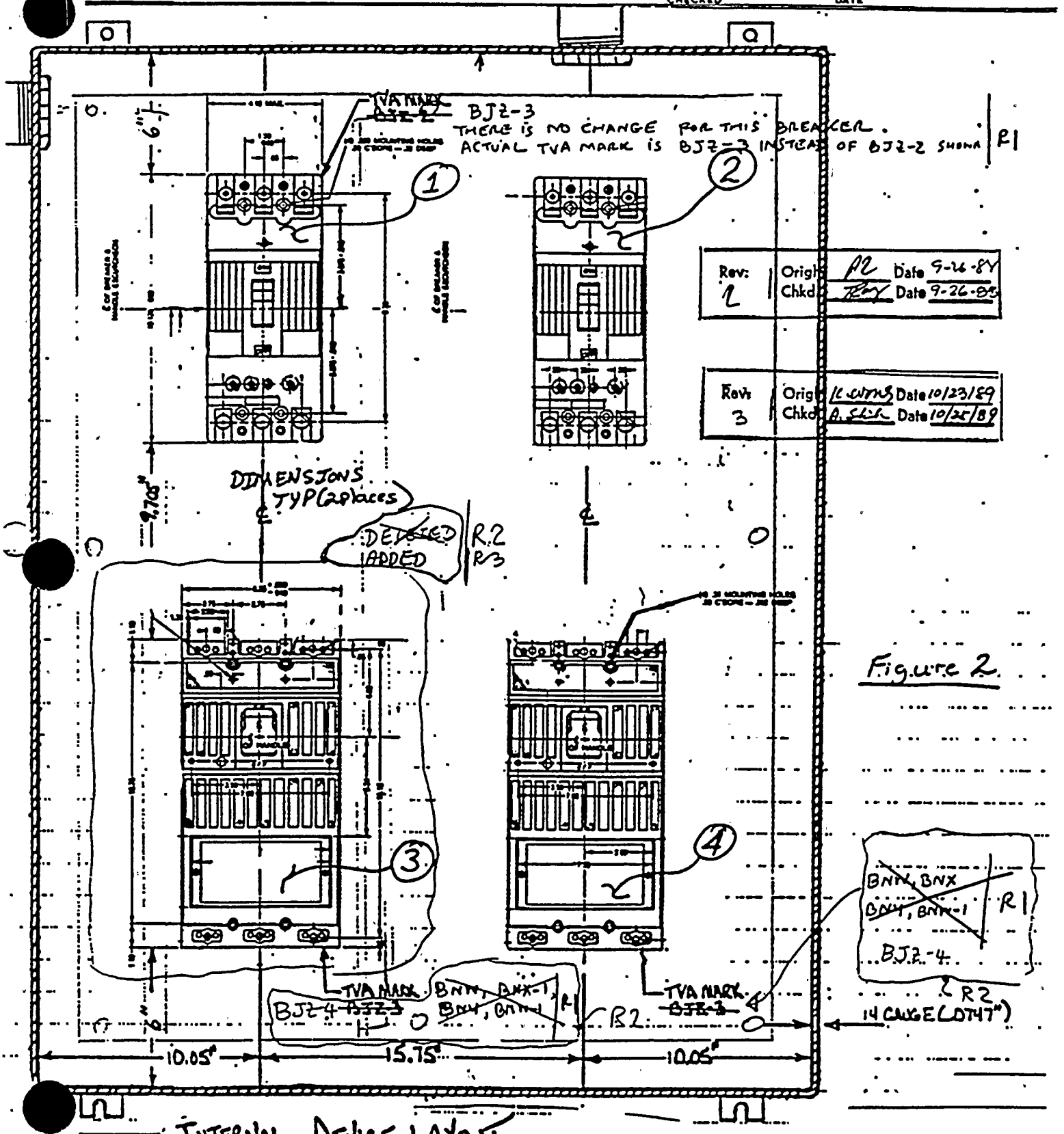


Figure 2.

INTERNAL DEVICE LAYOUT
CIRCUIT BREAKER BOX JB7193 & JB7196

BJ2-4 IS ORIGINAL TVA MARK NOT BJ2-3 AS SHOWN R2

~~BFEF01050~~ PAGE 6/7

CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196
ECN P0399

IO

ORIGINATOR: [illegible] 7-14-88 (R3)
CHECKED: [illegible] 7-15-88 B
COMPUTED _____ DATE _____ SHT. 6 OF [illegible] R3
CHECKED _____ DATE _____

BJZ-3 : GE J600 CIRCUIT BREAKER, GE PART # TJH65

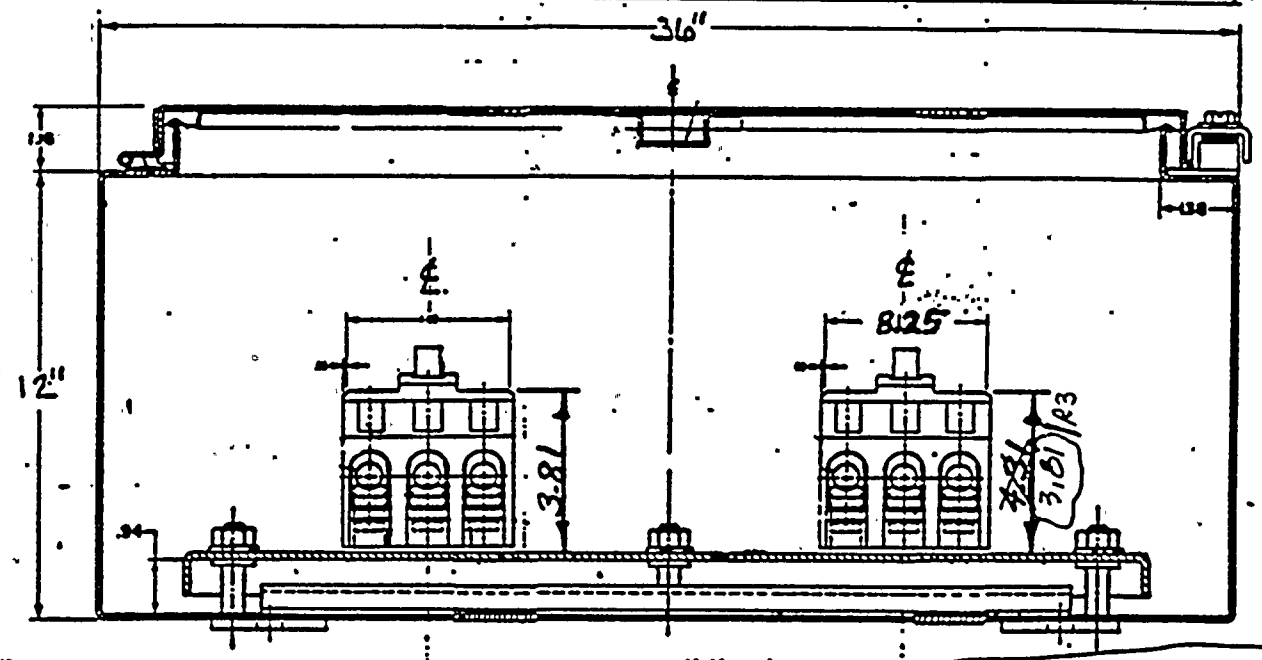
BNN: GE CIRCUIT BREAKER, J600 FRAME CAT # TJH365

BNX: J/K RATING PLUG (300A), GE CAT # TR3S300J R2

BNX-1: J/K RATING PLUG (225A), GE CAT # TR3S225J R1

BNW-1 : LUGS FOR BREAKER, GE CAT # TCAL43

BN4 : MICRO VERSATRIP RMS-9 PROGRAMMER, GE CAT # TS420LSIT1



THE WEIGHT OF THE REPLACEMENT BREAKERS AND EXISTING BREAKERS ARE APPROX. THE SAME BECAUSE ~~BOTH~~ OF THEM ARE IN GE J600 LINE BREAKER, THE DIFF. IS THE TRIP RATING. R

Figure 3

R2

TVA MARK #		WEIGHT
JWL		WT.* 148
		WT* 49
~~BJZ-2~~	BJZ-3 R1	WT* 12
~~BJZ-3~~ BJZ-4	BNN, ~~BNX OR~~ BNX-1, BN4, BNW-1 R1 R2	WT* 50

Table 1

Rev 3 | Origin. [illegible] Date 11/27/89
Chkd. A. [illegible] Date 10/27/89

Rev 2 | Origin. AL Date 9-26-88
Chkd. [illegible] Date 9-26-88

CENTER OF GRAVITY FOR
JUNCTION BOXES 7193 & 7196
ECN P0399

SHT. 7 OF 8 23

IO

Outline Drawings

F225 Line
Circuit Breaker

TVA MARK BJZ-3 R1

Revs	Origin	Date
3	Chkd. A. Shit	Date 10/25/89

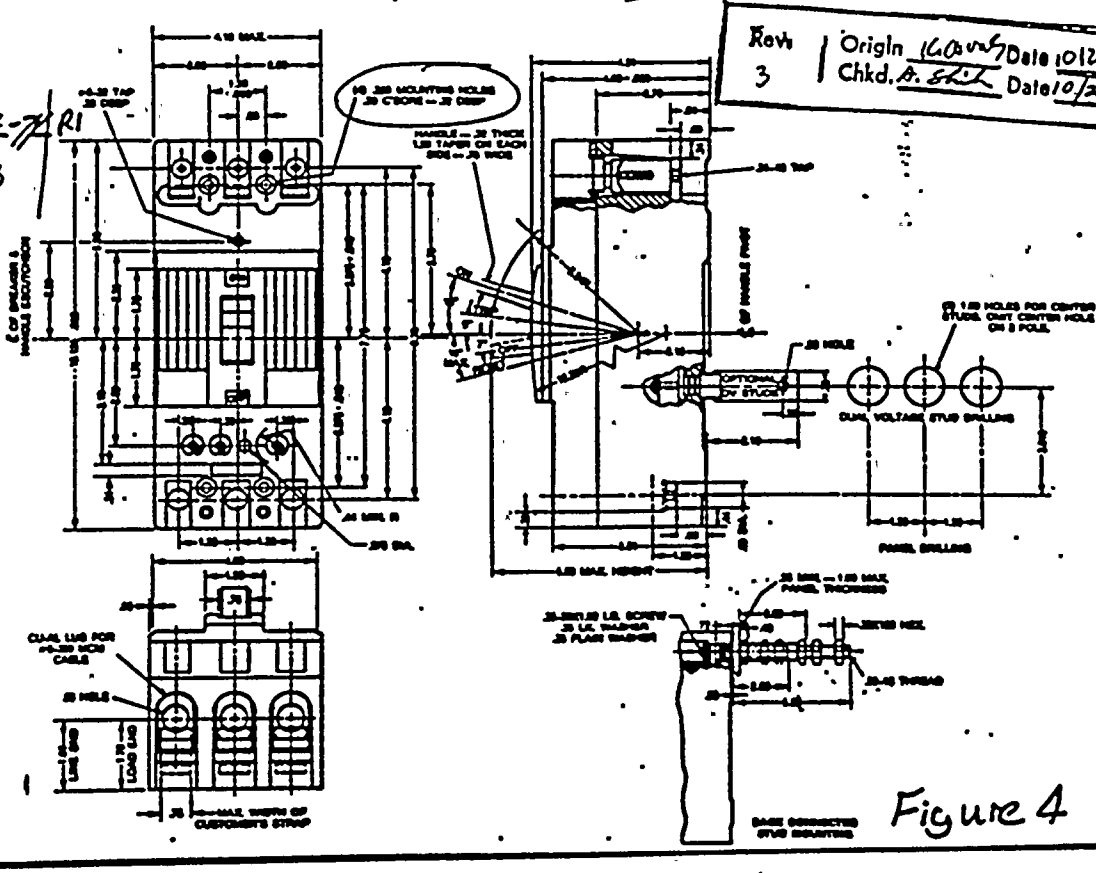


Figure 4

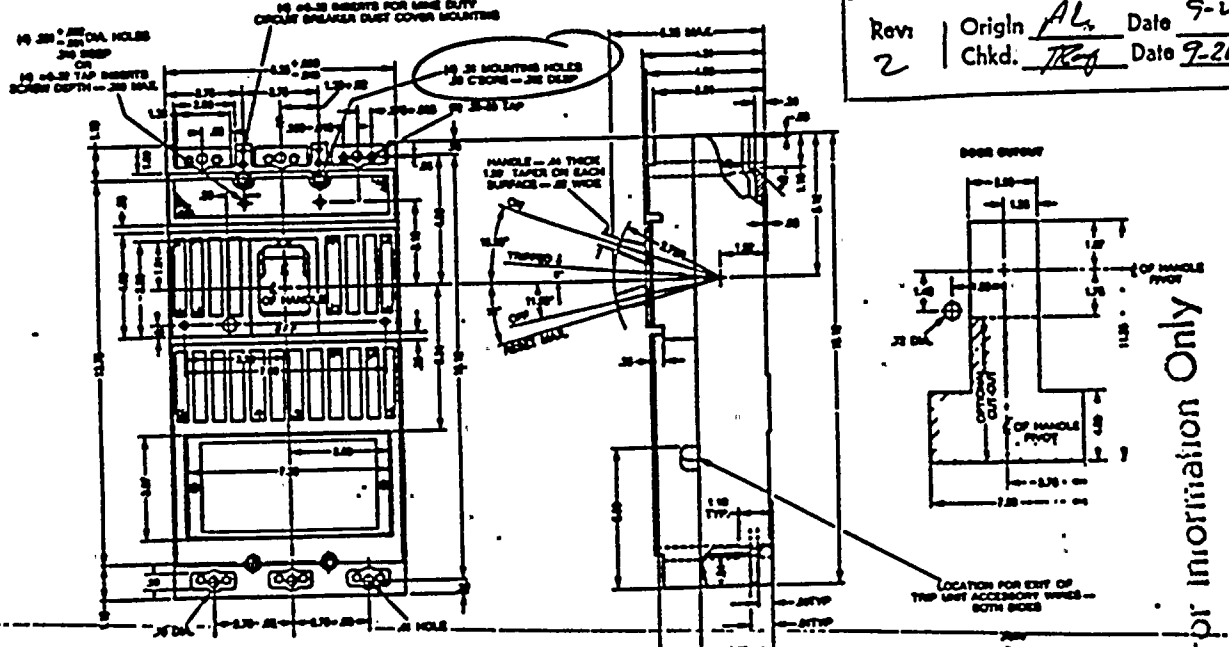
Outline Drawings

J600 Line
MicroVersaTrip™ 9
Circuit Breaker

TVA MARK ~~BJZ-3~~ BNW, BNX OR BNX-1 | R1 R2
BNW, BNW-1
BJZ-4

Figure 5

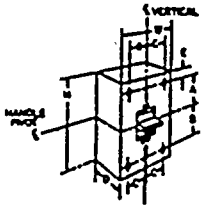
Revs	Origin	Date
2	Chkd.	Date 9-26-88

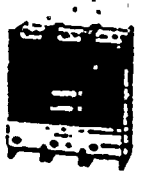


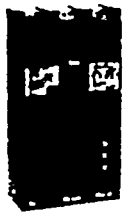
For information Only

GE ELECTRICAL DISTRIBUTION & CONTROL
BUYLOG CATALOG NO. GEP-1100 0288 UPU

CENTRE OF GRAVITY FOR JUNCTION BOX 7193 & 7196
DCN#6816A & #6841A.
SHT. 8 OF 8




TJC


TJL6S

Molded Case Circuit Breakers

Quick Reference Guide

Ratings do not apply to molded case switches.

Rev 3 | Origin K Wong Date 10/23/89
Chkd. A. Shih Date 10/25/89

Mag-Break® (UL File E11592; Magnetic Trip Unit)

Circuit Breaker Type	Ampere Rating	No. Poles	Maximum Voltage Rating ac	Maximum Voltage Rating dc	UL Listed Interrupting Ratings—rms Symmetrical Amps (in Thousands) ac Voltage 120	120/240	240	277	480	600	dc Voltage 125	250	Dimensions (in.) H	W	D	A	B	C	E	Approx. Ship Wt./ Std. Pack.
TBC4	225-400	3	600	—	—	—	100	—	100	100	—	—	16⅛	8¼	4½	3⁹⁄₁₆	9¹³⁄₁₆	1⅛	1¹⁄₁₆	31 lb/1 33 lb/1
TJC	400-600	3	600	250 —	—	—	42	—	30	22	—	10	10⅛	8¼	3⁹⁄₁₆	3⁹⁄₁₆	3⁹⁄₁₆	1⅛	1¹⁄₁₆	16 lb/1 17⅛/1
TBC6	600	3	600	—	—	—	100	—	100	100	—	—	21⅛	8¼	5⅛	8⁹⁄₁₆	12¹⁄₁₆	1⅛	⅛	53 lb/1 55 lb/1
TKC	800-1200	3	600	250 —	—	—	42	—	30	22	—	10	15½	8¼	5½	8⁹⁄₁₆	5¹¹⁄₁₆	1⅛	⅛	38 lb/1 41⅛/1
TBC8	800	3	600	—	—	—	100	—	100	100	—	—	21⅛	8¼	5⅛	8⁹⁄₁₆	12¹⁄₁₆	1⅛	⅛	53 lb/1 55 lb/1

MicroVersaTrip® (UL File E11592; Solid State Trip Units)

TJ4V⊙	150-600	3	600	—	—	42	42	—	30	22	—	—	10⅛	8¼	3⁹⁄₁₆	3⁹⁄₁₆	4½	2¾	1¹⁄₁₆	—
THJ4V⊙						65	65		35	25										
TJL4V⊙						100	100		65	30										
TK4V⊙	800-1200	3	600	—	—	42	42	—	30	22	—	—	15½	8¼	5½	8⁹⁄₁₆	5¹¹⁄₁₆	1⅛	⅛	—
TKL4V⊙	800-1200	3	600	—	—	100	100	—	65	42	—	—	15½	8¼	5½	8⁹⁄₁₆	5¹¹⁄₁₆	1⅛	⅛	—
TJH1S-6S	60-600	3	600	—	—	65	65	—	35	25	—	—	16⅛	8¼	3⁹⁄₁₆	3⁹⁄₁₆	9¹³⁄₁₆	1⅛	1¹⁄₁₆	
TJL1S-6S	60-600	3	600	—	—	100	100	—	65	30	—	—	16⅛	8¼	3⁹⁄₁₆	3⁹⁄₁₆	9¹³⁄₁₆	1⅛	1¹⁄₁₆	—
TKH6S,12S	300-1200	3	600	—	—	65	65	—	50	25	—	—	21⅛	8¼	5½	8⁹⁄₁₆	12¹⁄₁₆	1⅛	⅛	—
TKL6S,12S	300-1200	3	600	—	—	100	100	—	65	42	—	—	21⅛	8¼	5½	8⁹⁄₁₆	12¹⁄₁₆	1⅛	⅛	—

USED FOR R3

TLB High Interrupting Lines (UL File E11592; Fixed Thermal Magnetic Trip Units)

TLB4	250-400	3	480	—	—	—	85	—	50	—	—	—	13¹⁄₁₆	5²³⁄₃₂	4⅛	5²³⁄₃₂	4¹⁷⁄₃₂	1¾	⁹⁄₃₂	—

THLC Current Limiting Line (UL File E11592; Fixed Thermal Magnetic Trip Units)

THLC1	15-150	3	480	—	—	—	200	—	150	—	—	—	8¼	4⅛	4¼	5⅛	2⅛	1⅛	⅜	—
THLC2	125-225	3	480	—	—	—	200	—	150	—	—	—	11⁷⁄₁₆	5²³⁄₃₂	4⅛	5²³⁄₃₂	4¹⁷⁄₃₂	1¾	⁹⁄₃₂	—
THLC4	250-400	3	480	—	—	—	200	—	150	—	—	—	13¹⁄₁₆	5²³⁄₃₂	4⅛	5²³⁄₃₂	4¹⁷⁄₃₂	1¾	⁹⁄₃₂	—

Q-Line and TEB Molded Case Switches Short Circuit Withstand Rating①

Molded Case Switch Catalog Number	Maximum Rating Protective Device② Voltage	Amps	Short Circuit Withstand Rating Amps rms Sym.
TQL, TQB, TQC21Y60	120/240	60	10,000
TQL, TQB, TQC 21Y100	120/240	100	10,000
TQL, TQB, TQC22Y60	240	60	10,000
TQL, TQB, TQC22Y100	240	100	10,000
TQL, TQB, TQC32Y60	240	60	10,000
TQL, TQB, TQC32Y100	240	100	10,000
TEB111Y100	240	100	10,000
TEB122Y100	240	100	10,000
TEB132Y100	240	100	10,000

① Q-Line and TEB molded case switches have a 10,000 amp symmetrical short circuit withstand rating when protected by a fuse or circuit breaker rated 10,000 amps IC or greater and whose ampere rating does not exceed the ampere rating of the switch.

② Protective device must be on line side of molded case switch.

③ Three-pole, 600 volt switches cover 2-pole, 600 volt and 2- and 3-pole, 480 volt switches.

④ With MicroVersaTrip® 4-function programmer.

Molded Case Switches Short Circuit Withstand Rating

Molded Case Switch Ampere Rating	Catalog Number	Protective Device① Type	Max. Amp Rating	Short Circuit Withstand Ratings Amps rms Sym.	Max. Voltage
100	TED113Y100	Any fuse or circuit breaker rated 10 000A 240V	100	10,000	240
100	TED134Y100	TED134100	100	14,000	480
150	TED136Y150	TED136150	150	14,000	600
		TED134150	150	14,000	480
225	TFJ236Y225	TED, THED TFJ, TFK, THFK Class J Fuse	150 225 400	14,000 14,000 14,000	600 600 600
225	TQD32Y225	TQD	225	14,000	240
400	TJD432Y400	TJD Class T Fuse	400 400	22,000 50,000	240 240
400	TJJ436Y400	TFJ, TFK, THFK TJJ, THJK, TJ4V, THJ4V, THJ9V, THJ9VV Class J Fuse	225 400 400	18,000 22,000 22,000 30,000 50,000	600 480 600 480 600
600	TJK636Y600	TJJ, THJK, TJ4V, THJ4V, THJ9V, THJ9VV Class J Fuse TJK, THJK, TJ4V, THJ4V, THJ9V, THJ9VV	400 600 600	22,000 30,000 50,000 22,000 30,000	600 480 600 600 480
800	TKMA836Y800	TJK, THJK, TJ4V, THJ4V, THJ9V, THJ9VV THJ4, THK4, TK4V, THK4V, THK9V, THK9VV Class L Fuse	600 800 800	22,000 30,000 22,000 30,000 50,000	600 480 600 480 600
1200	TKMA3Y1200	TJK, THJK, TJ4V, THJ4V, THJ9V, THJ9VV THJ4, THK4, TK4V, THK4V THJ9V, THJ9VV Class L Fuse	600 1200 1200	22,000 30,000 22,000 30,000 50 000	600 480 600 480 600

Time Current Curves—see Section 19.
Outline Drawings—see Section 19.

FOR INFORMATION ONLY