EASE

EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING
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PATTERSON-KELLEY
HiDRA WATER HEATER
## HC-800 / HC-1000

DES.	J. ROBERSON	SHEET
JOB NO.	11-1820	1
DATE	6/21/18	OF 3 SHEETS

SEISMIC ANCHORAGE   SLAB ON GRADE

C.G. WT. = 1963 LB

(4)- 3/8"⌀ (GRADE 5) WELD STUDS TO BASE PLATE W/ 3/8" NUTS & STD WASHERS (WELD ASSUMED TO DEVELOP STRENGTH OF BOLT)

(4)- 5/8"⌀ HILTI KB-TZ EXPANSION ANCHORS (MIN. EMBED. (h_{ef}) = SEE SCHED)

NORMAL WEIGHT CONCRETE FLOOR SLAB (BY STRUCTURAL ENGINEER OF RECORD) (f'_c = 3000 PSI MIN)

37.1"

T_{SLAB} (MIN) SEE SCHED BELOW

V_U V_U

T_U T_U

FRONT ELEVATION
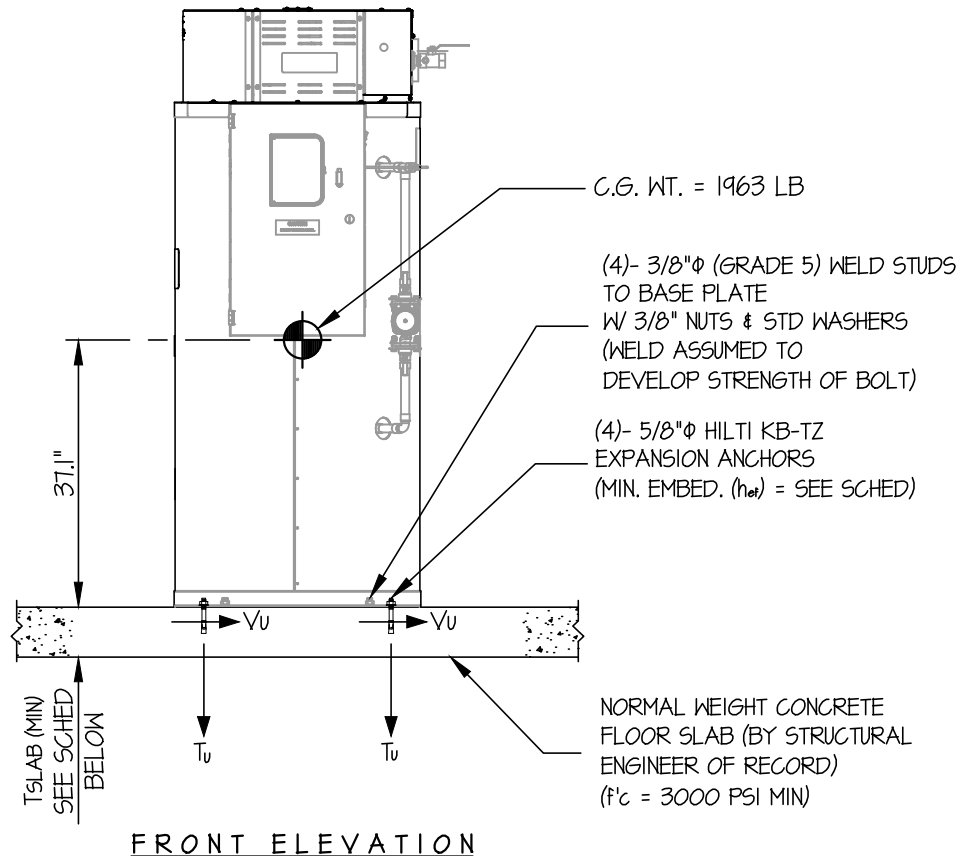
| MAX S_{DS} | ANCHORS | | | | | | |
	TYPE	DIAM	EFF EMBED	QTY	T_{SLAB}	T_U (lb.)	V_U (lb.)
1.50	HILTI KB-TZ	5/8"	3.125"	4	5"	2255	901
2.10	HILTI KB-TZ	5/8"	4"	4	6"	3346	1261

NOTES:

1. FORCES ARE DETERMINED PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10 STRENGTH DESIGN IS USED. (a_p = 1.0, I_p = 1.5, R_p = 2.5, Ω_0 = 2.0, z/h = 0)

2. CENTER OF GRAVITY (C.G.) AND WEIGHT ARE THE GOVERNING PARAMETERS FOR DESIGN. THESE CALCULATIONS ENCOMPASS ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.

3. STRUCTURAL ENGINEER OF RECORD FOR THE BUILDING SHALL PROVIDE SUPPORT STRUCTURE DESIGNED TO SUPPORT WEIGHTS AND FORCES SHOWN, IN COMBINATION WITH ALL OTHER LOADS THAT MAY BE PRESENT.

REGISTERED PROFESSIONAL ENGINEER
JONATHAN ROBERSON
No. 4197
EXP. 6-30-2020
6/21/18
STRUCTURAL
STATE OF CALIFORNIA

NOT STRUCTURAL ENGINEER OF RECORD

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DES.	J. ROBERSON	SHEET **2**
JOB NO.	11-1820	
DATE	6/21/18	OF **3** SHEETS

SEISMIC ANCHORAGE   MAX $S_{DS} \leq 1.50$ SLAB ON GRADE
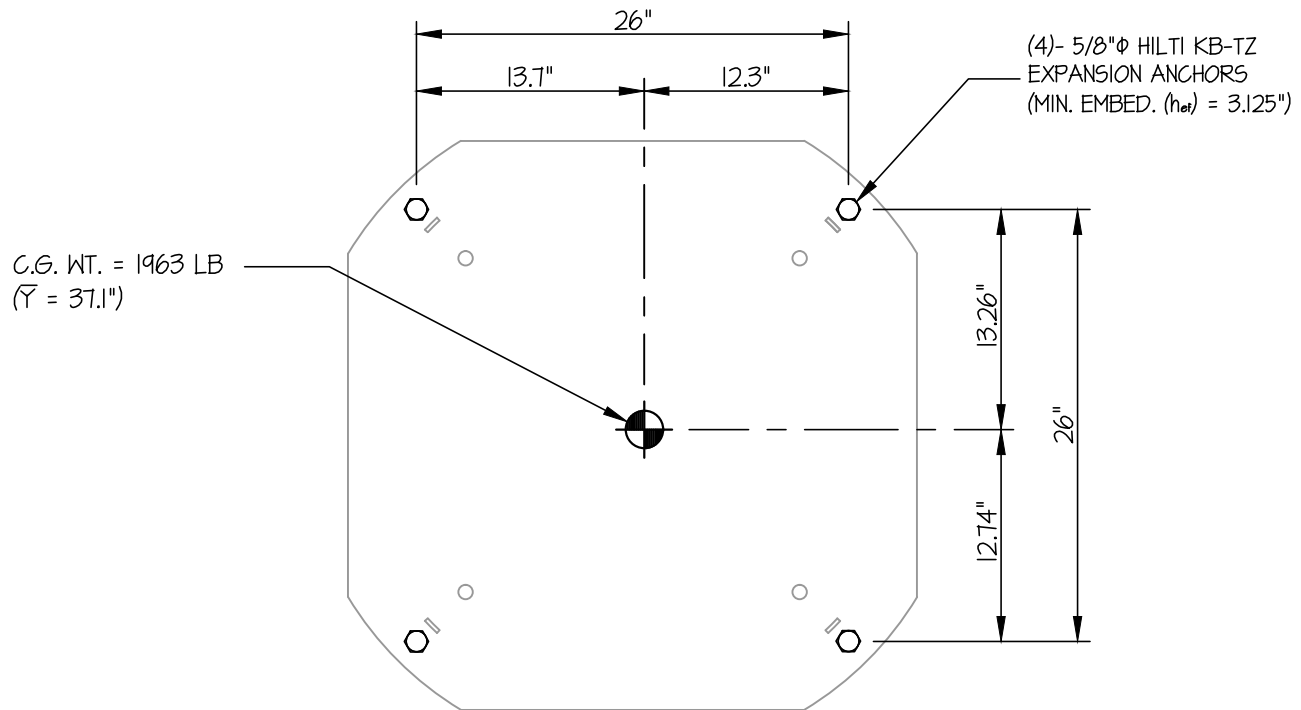
26"

13.7"   12.3"

(4)- 5/8"φ HILTI KB-TZ
EXPANSION ANCHORS
(MIN. EMBED. (h_{ef}) = 3.125")

C.G. WT. = 1963 LB
($\bar{Y}$ = 37.1")

13.26"

26"

12.74"

P L A N   A T   B A S E

MODELS	WEIGHT (lb.)
HC-800	1958
* HC-1000	1963

* USED IN CALCULATION

LOADS: PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10
         STRENGTH DESIGN IS USED (S_{DS} = 1.50, a_p = 1.0, I_p = 1.5, R_p = 2.5, Ω_o = 2.0, z/h = 0)
WEIGHT = 1963 LB
HORIZONTAL FORCE (E_{mh}) = 1.35 W_p = 2650 LB
VERTICAL FORCE (E_v) = 0.30 W_p = 589 LB

BOLT FORCES: (FLOOR PLATE TO CONCRETE)

BOLT SPECS: 5/8"φ HILTI KB-TZ (h_{ef} = 3.125")
ϕT = 0.75ϕNn = 2508 LB/BOLT   (TENSION)
ϕV = ϕVn = 4940 LB/BOLT   (SHEAR)

TENSION (T)

$$T_{u \text{ MAXIMUM}} = \left[\frac{2650\#(37.1")(13.26")}{1 \text{ BOLT}(26")(26")} \times (0.3) \right] + \frac{2650\#(37.1")(13.7")}{1 \text{ BOLT }(26")(26")} - \frac{(1963\#(0.9) - 589\#)(13.7")(13.26")}{1 \text{ BOLT }(26")(26")} = 2255 \text{ LB/BOLT (MAX)}$$

(HORIZ - SIDE TO SIDE)   (HORIZ - FRONT TO BACK)   (WEIGHT (0.9) - E_v)

SHEAR (V)

$$V_{u \text{ MAXIMUM}} = \left[\frac{2650\#(13.26")}{2 \text{ BOLTS }(26")} \times (0.3) \right] + \frac{2650\#(13.7")}{2 \text{ BOLTS }(26")} = 901 \text{ LB/BOLT (MAX)}$$

UNITY CHECK:

$$\left(\frac{T_u}{\phi T} \right) + \left(\frac{V_u}{\phi V} \right) \leq 1.2 \quad \left(\frac{2255}{2508} \right) + \left(\frac{901}{4940} \right) = 1.08 \leq 1.2 \quad \therefore \quad \underline{O.K.}$$

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PATTERSON-KELLEY	DES. **J. ROBERSON**	SHEET **3**
HiDRA WATER HEATER HC-800 / HC-1000	JOB NO. **11-1820**	
	DATE **6/21/18**	OF **3** SHEETS

SEISMIC ANCHORAGE   1.50 < MAX S_{DS} ≤ 2.10   SLAB ON GRADE
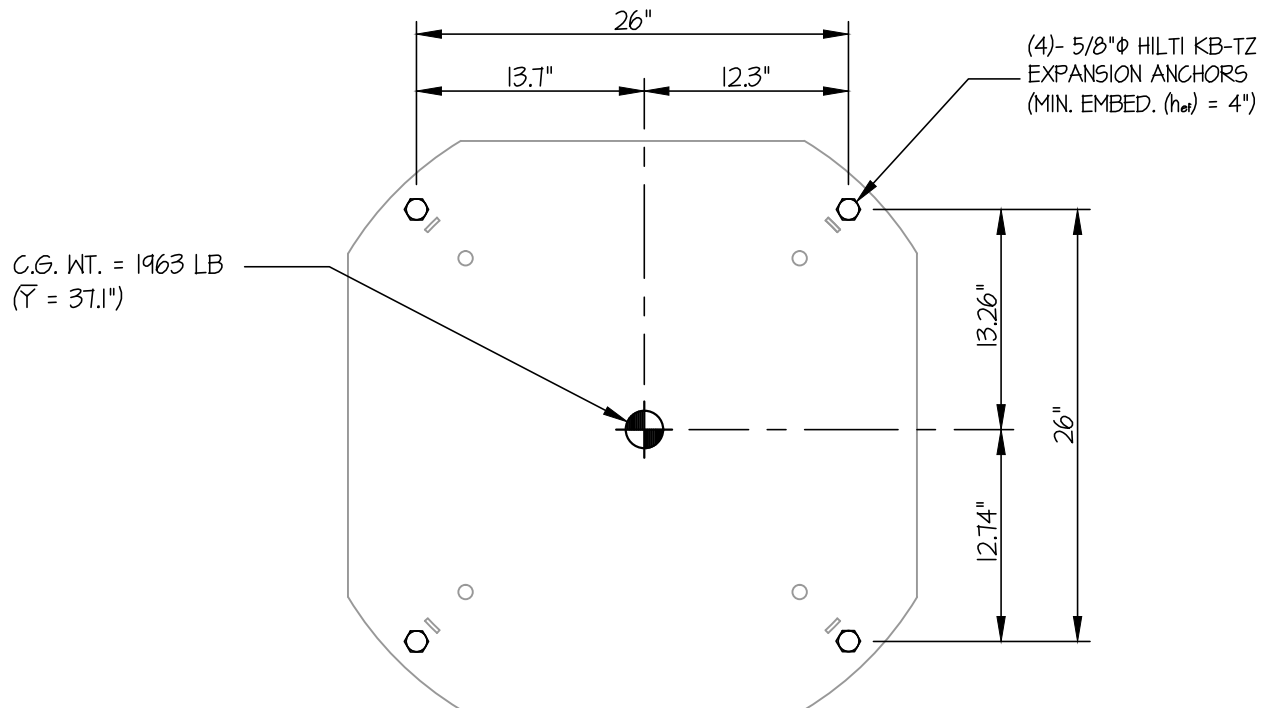
26"
13.7"   12.3"

(4)- 5/8"φ HILTI KB-TZ EXPANSION ANCHORS (MIN. EMBED. (h_{ef}) = 4")

C.G. WT. = 1963 LB ($\overline{Y}$ = 37.1")

13.26"
26"
12.74"

PLAN AT BASE

MODELS	WEIGHT (lb.)
HC-800	1958
* HC-1000	1963

* USED IN CALCULATION

LOADS: PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10

STRENGTH DESIGN IS USED (S_{DS} = 2.10, a_p = 1.0, I_p = 1.5, R_p = 2.5, Ω_o = 2.0, z/h = 0)

WEIGHT = 1963 LB

HORIZONTAL FORCE (E_{mh}) = 1.89 W_p = 3710 LB

VERTICAL FORCE (E_v) = 0.42 W_p = 824 LB

BOLT FORCES: (FLOOR PLATE TO CONCRETE)

BOLT SPECS: 5/8"φ HILTI KB-TZ (h_{ef} = 4")
ϕT = 0.75ϕNn = 3632 LB/BOLT   (TENSION)
ϕV = ϕVn = 4940 LB/BOLT   (SHEAR)

TENSION (T)

$$T_{u\ MAXIMUM} = \left[\frac{3710\#(37.1")(13.26")}{1_{BOLT}(26")(26")} \times (0.3) \right] + \frac{3710\#(37.1")(13.7")}{1_{BOLT}(26")(26")} - \frac{(1963\#(0.9) - 824\#)(13.7")(13.26")}{1_{BOLT}(26")(26")} = 3346\ LB/BOLT\ (MAX)$$

(HORIZ - FRONT TO BACK)   (HORIZ - SIDE TO SIDE)   (WEIGHT (0.9) - E_v)

SHEAR (V)

$$V_{u\ MAXIMUM} = \left[\frac{3710\#(13.26")}{2_{BOLTS}(26")} \times (0.3) \right] + \frac{3710\#(13.7")}{2_{BOLTS}(26")} = 1261\ LB/BOLT\ (MAX)$$

UNITY CHECK:

$$\left(\frac{T_u}{\phi T} \right) + \left(\frac{V_u}{\phi V} \right) \leq 1.2 \qquad \left(\frac{3346}{3632} \right) + \frac{1261}{4940} = 1.18 \leq 1.2 \ \therefore \ \underline{O.K.}$$

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SEISMIC ANCHORAGE   UPPER FLOOR

C.G. WT. = 1963 LB

(4)- 3/8"∅ (GRADE 5) WELD STUDS
TO BASE PLATE
W/ 3/8" NUTS & STD WASHERS
(WELD ASSUMED TO
DEVELOP STRENGTH OF BOLT)

(4)- 5/8"∅ (A36) THREADED RODS
THRU FLOOR (HOLES TO BE 1/16"
LARGER THAN BOLT DIAMETER MAX.)

37.1"

V_u

V_u

T_u T_u

FLOOR SLAB (BY STRUCTURAL
ENGINEER OF RECORD)

STRUT BENEATH FLOOR
(BY STRUCTURAL
ENGINEER OF RECORD)
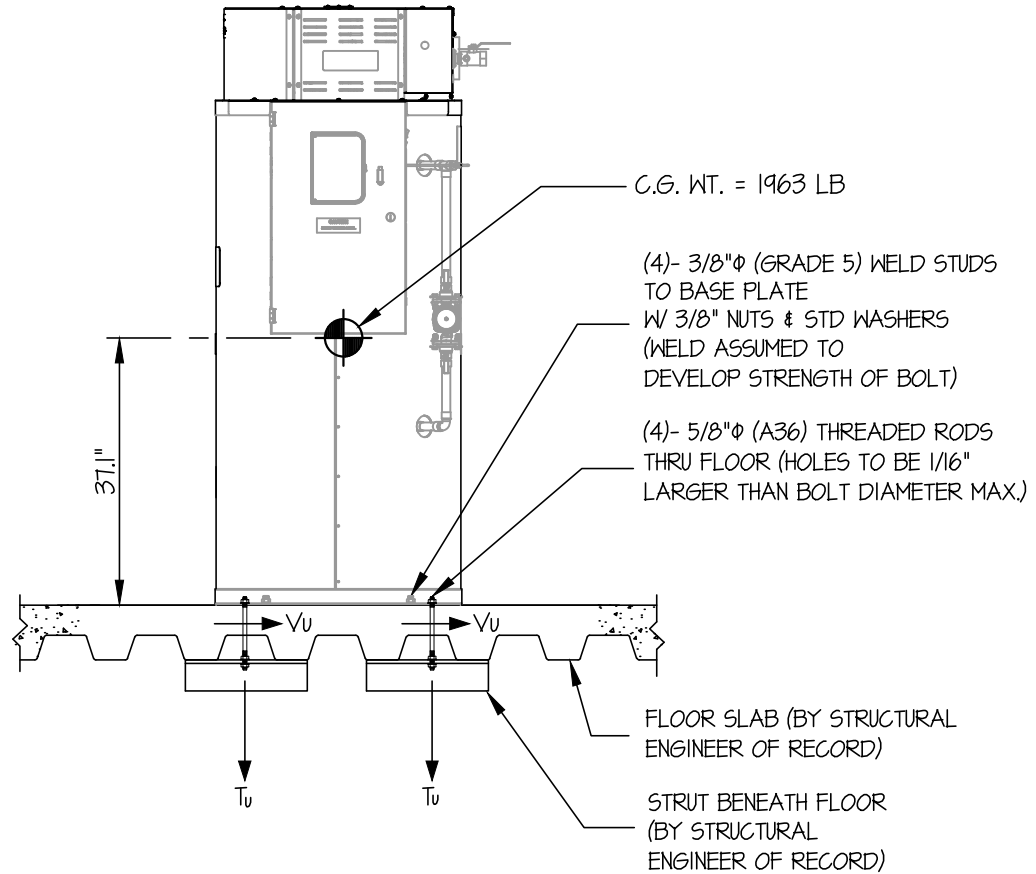
<u>FLOOR PLATE TO CONCRETE</u>
T_u = 2766 LB/BOLT (MAX)
V_u = 1054 LB/BOLT (MAX)

<u>UNIT PLATE TO FLOOR PLATE</u>
T_u = 3695 LB/BOLT (MAX)
V_u = 1068 LB/BOLT (MAX)

<u>F R O N T   E L E V A T I O N</u>

NOTES:

1. **FORCES ARE DETERMINED PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10.**

   STRENGTH DESIGN IS USED. (S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 2.5, z/h $\leq$ 1)

   HORIZONTAL FORCE (E_h) = 1.58 W_p
   VERTICAL FORCE (E_v) = 0.44 W_p

2. CENTER OF GRAVITY (C.G.) AND WEIGHT ARE THE GOVERNING PARAMETERS FOR DESIGN.
   THESE CALCULATIONS ENCOMPASS ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.

3. STRUCTURAL ENGINEER OF RECORD FOR THE BUILDING SHALL PROVIDE SUPPORT STRUCTURE
   DESIGNED TO SUPPORT WEIGHTS AND FORCES SHOWN IN COMBINATION WITH ALL OTHER
   LOADS THAT MAY BE PRESENT.

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SEISMIC ANCHORAGE   UPPER FLOOR

PLAN AT BASE

(4)- 5/8"φ (A36) THREADED RODS THRU FLOOR (HOLES TO BE 1/16" LARGER THAN BOLT DIAMETER MAX.)

C.G. WT. = 1963 LB
($\overline{Y}$ = 37.1")

MODELS	WEIGHT (lb.)
HC-800	1958
* HC-1000	1963

* USED IN CALCULATION

LOADS: PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10
    STRENGTH DESIGN IS USED (S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 2.5, z/h $\leq$ 1)
WEIGHT = 1963 LB
HORIZONTAL FORCE (E_h) = 1.58 W_p = 3102 LB
VERTICAL FORCE (E_v) = 0.44 W_p = 864 LB
BOLT FORCES: (FLOOR PLATE TO CONCRETE)

TENSION (T)

$$T_{u \text{ MAXIMUM}} = \left[\frac{3102\#(37.1")(13.26")}{1 \text{ BOLT } (26")(26")} \times (0.3) \right] + \frac{3102\#(37.1")(13.7")}{1 \text{ BOLT } (26")(26")} - \frac{(1963\#(0.9) - 864\#)(13.7")(13.26")}{1 \text{ BOLT } (26")(26")} = 2766 \text{ LB/BOLT (MAX)}$$

(HORIZ - SIDE TO SIDE)   (HORIZ - FRONT TO BACK)   (WEIGHT (0.9) - E_v)

SHEAR (V)

$$V_{u \text{ MAXIMUM}} = \left[\frac{3102\#(13.26")}{2 \text{ BOLTS } (26")} \times (0.3) \right] + \frac{3102\#(13.7")}{2 \text{ BOLTS } (26")} = 1054 \text{ LB/BOLT (MAX)}$$

BOLT SPECS: 5/8"φ (A36) THREADED ROD
φT = 10,016 LB/BOLT   (TENSION)
φV = 5342 LB/BOLT   (SHEAR)

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SEISMIC ANCHORAGE   UPPER FLOOR

C.G. WT. = 1963 LB
($\bar{Y}$ = 37.1")

(4)- 3/8"φ (GRADE 5) WELD STUDS
TO BASE PLATE
W/ 3/8" NUTS & STD WASHERS
(WELD ASSUMED TO
DEVELOP STRENGTH OF BOLT)
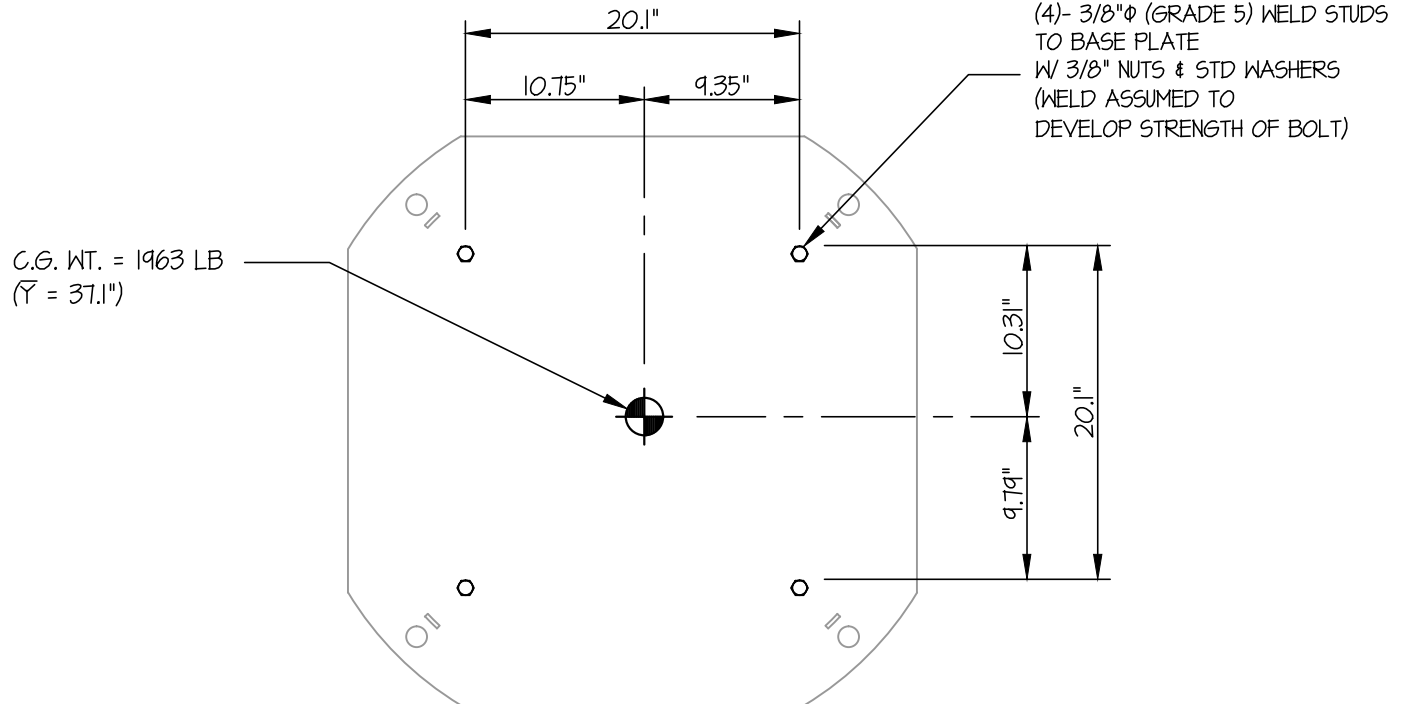
P L A N   A T   B A S E

MODELS	WEIGHT (lb.)
HC-800	1958
* HC-1000	1963

* USED IN CALCULATION

LOADS: PER 2016 CALIFORNIA BUILDING CODE AND ASCE 7-10
    STRENGTH DESIGN IS USED (S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 2.5, z/h $\leq$ 1)
WEIGHT = 1963 LB
HORIZONTAL FORCE (E_h) = 1.58 W_p = 3102 LB
VERTICAL FORCE (E_v) = 0.44 W_p = 864 LB
BOLT FORCES: (UNIT PLATE TO FLOOR PLATE)

BOLT SPECS: 3/8"φ (GRADE 5) WELD STUD
φT= 7455 LB/BOLT   (TENSION)
φV= 3877 LB/BOLT   (SHEAR)

TENSION (T)

$$T_{u \text{ MAXIMUM}} = \left[\frac{3102\#(37.1")(10.31")}{1 \text{ BOLT } (20.1")(20.1")} \times (0.3) \right] + \frac{3102\#(37.1")(10.75")}{1 \text{ BOLT } (20.1")(20.1")} - \frac{(1963\#(0.9) - 864\#)(10.75")(10.31")}{1 \text{ BOLT } (20.1")(20.1")} = 3695 \text{ LB/BOLT (MAX)}$$

(HORIZ - FRONT TO BACK)   (HORIZ - SIDE TO SIDE)   (WEIGHT (0.9) - E $_V$)

SHEAR (V)

$$V_{u \text{ MAXIMUM}} = \left[\frac{3102\#(10.31")}{2 \text{ BOLTS } (20.1")} \times (0.3) \right] + \frac{3102\#(10.75")}{2 \text{ BOLTS } (20.1")} = 1068 \text{ LB/BOLT (MAX)}$$