



SUBJECT

NAME

PETER DEVERE

DATE

REVISION DATE

Calculations & Repair Procedures

Two fastening methods are presented; welding and anchor-bolting. The weld size is determined by the maximum calculated reaction; 5000. pounds and the heat sink characteristics of the μ -filter steel's large mass. A weld procedure is presented on page 4 of this section which will avoid rapid cooling of the weldment and subsequent cracking. A procedure for installing HILTI anchor bolts is also presented as an equal alternative.

It should be noted from the enclosed photos; the physical properties of the μ -filter steel are not "construction quality." With this in mind, any fastening method or system used to anchor the cantilevered structure to the μ -filter steel requires some form of nondestructive testing or evaluation. The preferred NDE method for the fillet welds is ultrasonic evaluation. This will require an "outside contractor" to provide this service. The HILTI anchor bolt alternate also presents an "indeterminate" situation. Once the hole is drilled; inspected for voids and hardness values measured; metal defects close to the "tension zone" of the anchor bolt could affect the load carrying capacity of the anchorage. Verification of the load carrying capacity is determined by using the "proof load" procedure in this section. This procedure for proof loading must be applied to the anchorage if ultrasonic evaluation is **NOT** used to verify weld-quality, or if the HILTI anchor bolt system **is** employed.



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Weld Procedure

The following mandatory requirements must be addressed as part of the welding process.

- 1) Flame-Preheat μ -filter billet at weld location.
- 2) Monitor temperature of μ -filter surface at a 12 inch radius from the weld location.
- 3) Temperature must reach 400 deg. F prior to welding.
- 4) Maintain Interpass Temperature of at least 300 deg. F.
- 5) Upon completion of weld, use insulating blanket to prolong cooling period.
- 6) Conduct all NDE twenty-four hours after completion of all welding:
 - a) Dye Penetrant
 - b) Ultrasonic Inspection



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Installation Procedures for HILTI HSL M24/60 Anchor Bolt

- 1) Upon completion of Drilling Anchor Bolt Hole, conduct borescope inspection of the wall drill-hole. Verify that voids or inclusion will not interfere with the expansion head.
- 2) Measure Brinell hardness at bottom of drill hole and Expansion Wedge of HILTI anchor bolt. Brinell Hardness value of HILTI Expansion Wedge should be equal to or greater than the value measured at bottom of drill hole.
- 3) Fill annulus between billet steel and anchor bolt with appropriately specified epoxy. Allow sufficient curing time prior to Proof Load Testing.

Proof Testing of WELDED or BOLTED Connection:

A Proof Load Test must be applied to the welded or bolted connection prior to use.

The Proof Load is: $3 \times (\text{FACTORED REACTION}) = 15000 \text{ lbs.}$

Apply this load three separate times; each loading must start at 0 lbs. and increased to 15000. within a one minute cycle.

Upon completion of Proof Load Testing, verify that no bolt slippage has occurred; or if a welded connection is applied, perform Dye Penetrant Inspection.



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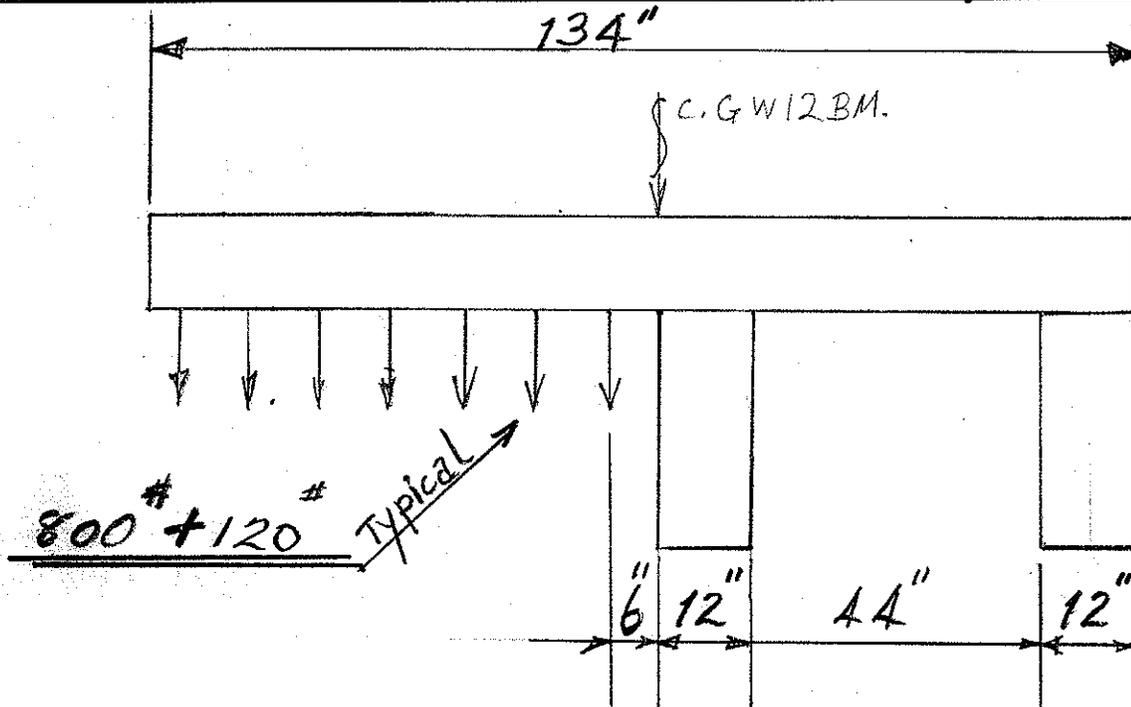
NAME

PETER DEVERE

DATE

9-11-95

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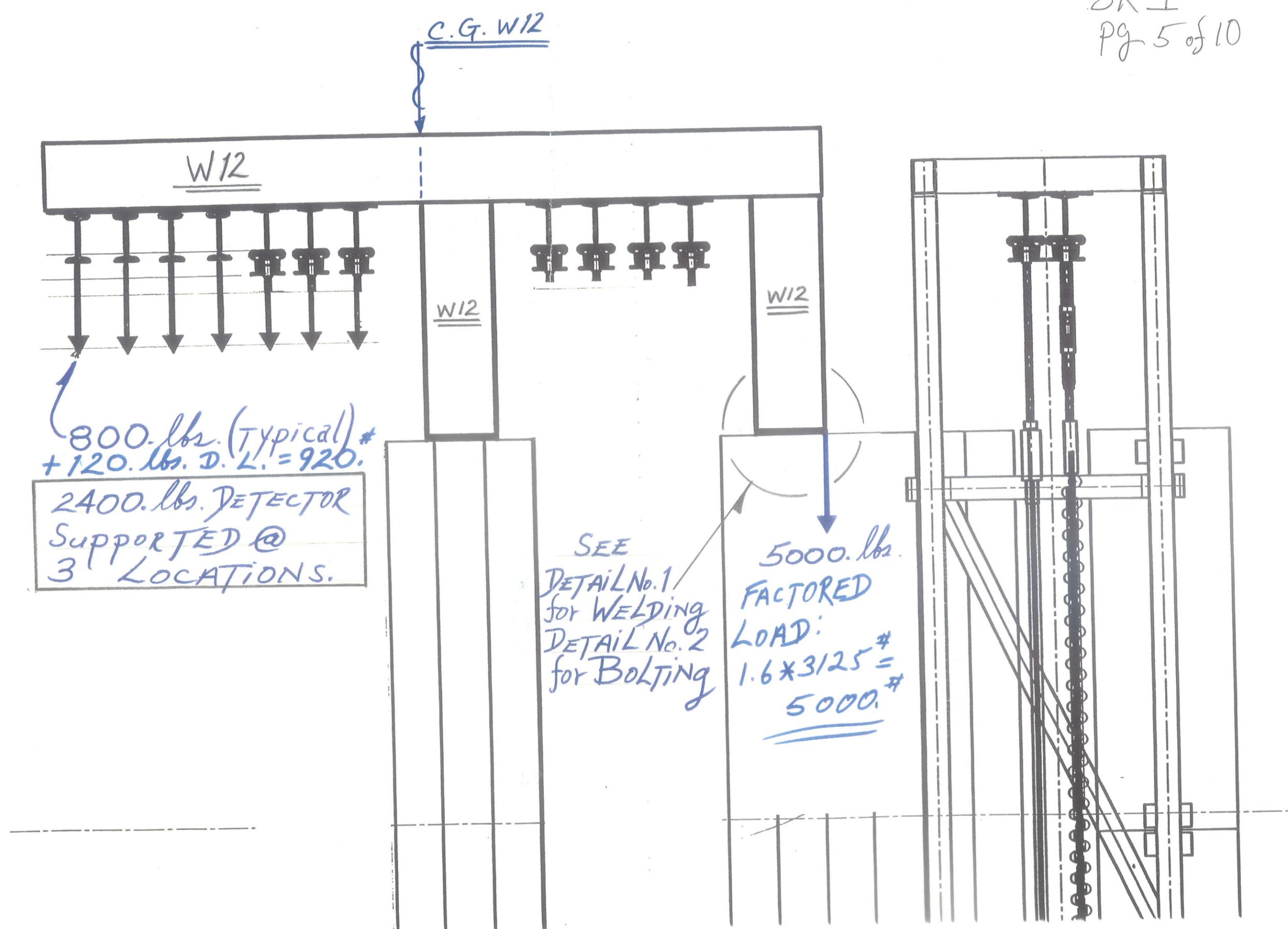
Free body diagram of the beam segment from the left end to the right support, with a length of 68".

$\sum M @ R_{LEFT} = 0$
 $-920 \cdot (60. + 51. + 42. + 33. + 24. + 15. + 6) + (R_{RIGHT} \cdot 68.)$

$$R_{RIGHT} = \frac{920 \cdot 231}{68} = 3125. \# \quad 212520$$

$\sum F_y = 0 - (7 \cdot 920) + R_{LEFT} - 3125. \#$

$$R_{LEFT} = 9565. \#$$



C.G. W12

W12

W12

W12

800. lbs. (Typical) #
+ 120. lbs. D. L. = 920.

2400. lbs. DETECTOR
SUPPORTED @
3 LOCATIONS.

SEE
DETAIL No. 1
FOR WELDING
DETAIL No. 2
FOR BOLTING

5000. lbs.
FACTORED
LOAD:
 $1.6 \times 3125 =$
5000. #



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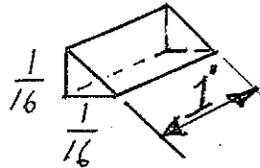
WELD DESIGN

NAME

PETER DEVERE

DATE

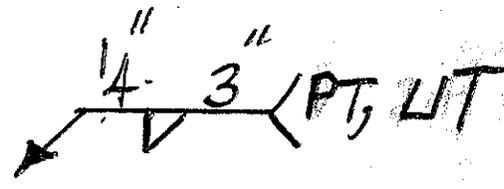
REVISION DATE

USE E70LH  = 0.928 $\frac{K}{in}$

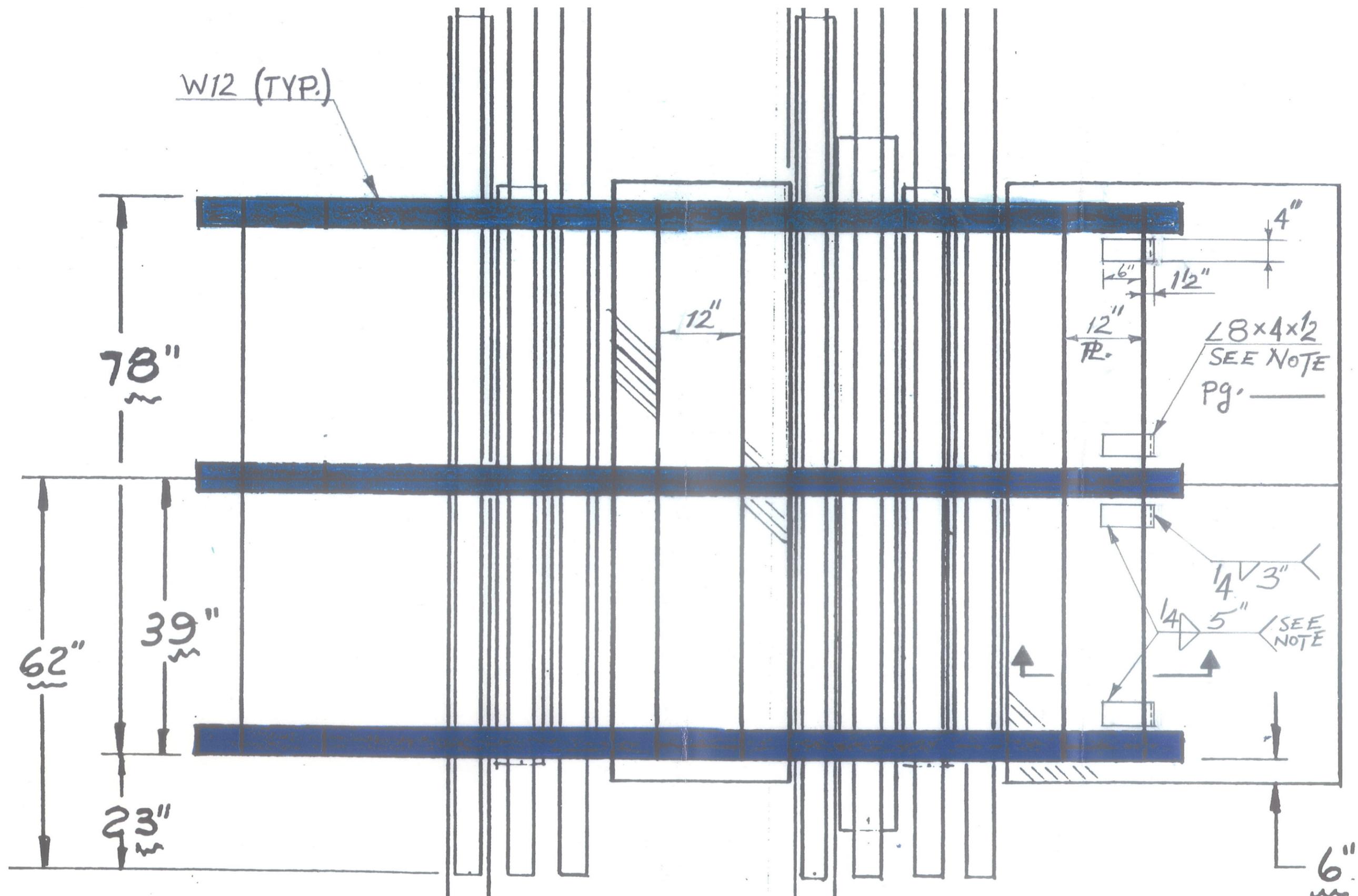
FACTORED LOAD = 1.6 * 3125 lb = 5000. lbs

μ -filter STEEL IS VERY MASSIVE;
∴ it ACTS AS A HEAT SINK.

WELDS APPLIED TO THE μ -filter
will COOL VERY RAPIDLY WITHOUT
PRE HEAT & MAINTENANCE OF
HIGH INTERPASS TEMP.

USE  (PT, LIT) (SEE WELD PROC.)

CAPACITY OF 1/4" WELD, 3 INCHES LONG:
 $4 * 0.928 \frac{K}{IN} * 3 INCH = \underline{\underline{11. Kips}} > \underline{\underline{5K}}$



DETAIL No. 1
PLAN VIEW

MSD-EN009
E831
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SUBJECT

HILTI ANCHOR BOLT

NAME

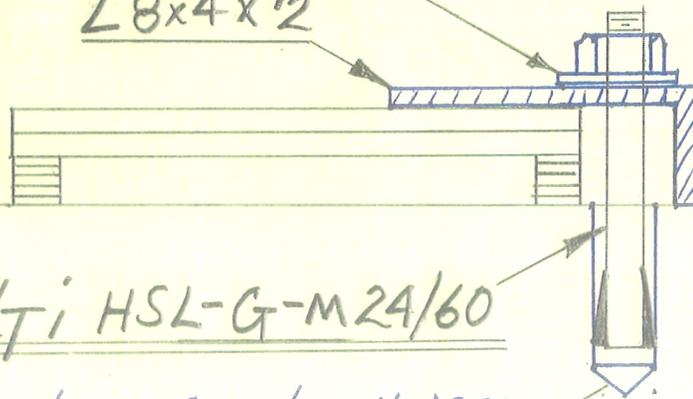
DATE

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TRIM 4" LEG TO MATCH
HEIGHT OF PLATE

OVER-SIZED HARDENED WASHER 1/4" TH.

L8x4x1/2



HILTI HSL-G-M24/60

E = 155mm

REF.: HILTI CATALOG H-437D
6/92 EDITION
FLAT-BOTTOM
HOLE IS PREFERRED

pg. 35 & 36

FACTORED LOAD: $1.6 \times 3125 \text{ lbs.} = 5000. \text{ lbs.}$
ALLOWABLE TENSION LOAD: 13000. lbs.

u-filter STEEL

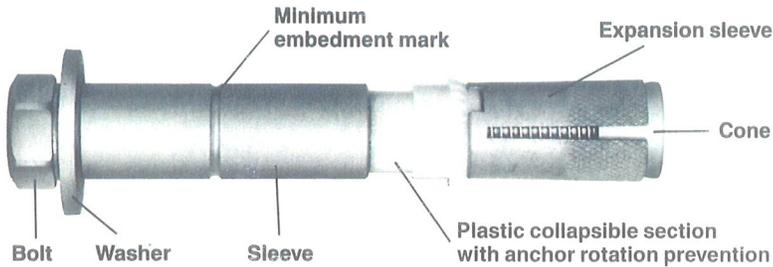
DETAIL No. 2

HSL Metric Heavy-Duty Expansion Anchor

Reliable heavy-duty anchor for heavy/dynamic loads

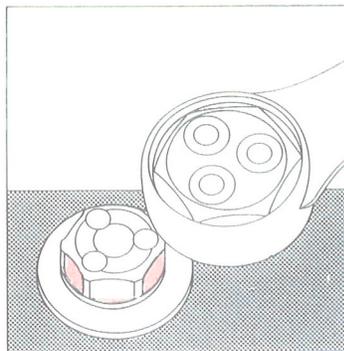
Product Details

Hilti HSL Heavy-Duty Anchor



MSE-ZN009
E-831

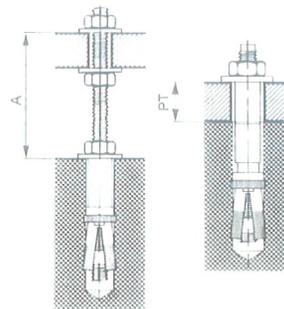
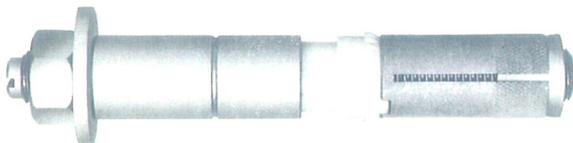
Hilti HSLB Heavy-Duty Anchor with Torque Cap



Red setting indicator

Three accurately sized shear pins are provided in the red indicator cap. On applying the required tightening torque with an ordinary wrench, the red indicator cap shears off. The green seal on the bolt head which appears indicates that the anchor has been tightened properly.

Hilti HSLG Heavy-Duty Anchor with Threaded Rod



The thickness fastened, PT, and the stand-off, A, can be varied. (Extra-long versions are available through specials.)

Advantages

- High Loading Capacity
- Force Controlled Expansion
- Reliable Pull-Down of Part Fastened
- Suitable for Dynamic Loading
- Suitable for Tension Zone
- No Rotation When Tightening Bolt or Nut

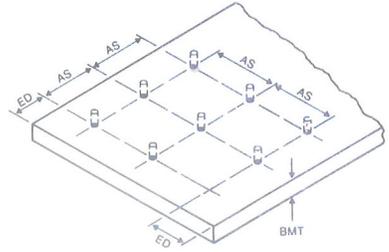
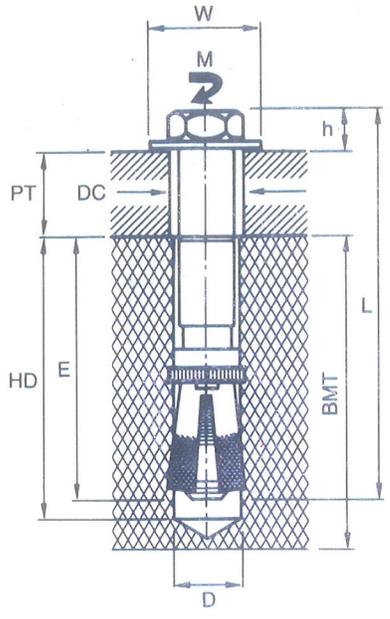
Bolt/Rod Material

HSL-R/HSLG-R:	Stainless Steel Type 316	HSLB/HSL/HSLG:	Steel to min. UTS of 116 ksi
	UTS min. of 101.5 ksi		Yield of 92.8 ksi
	Yield of 65.25 ksi		Zinc plated to min. 5 μm

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HSL Metric Specification Table

Anchor continued



Notes:

1. When using AS_{min} reduce the working load by 30%
2. When using ED_{min} and the load is a shear load, reduce the working load by 70%
3. When using ED_{min} and the load is a tensile load, reduce the working load by 30%
4. To convert mm's to inches divide by 25.4

Setting details		
D (mm)	drill bit dia.	
HD (mm)	hole depth	
E (mm)	min. depth of embedment	
AS	spacing required to obtain maximum working load (mm)	
AS min	Minimum allowable spacing between anchors (mm) Refer to note 1	
ED	Edge distance required to obtain maximum working load (mm)	
ED min	Minimum allowable edge distance (mm) Refer to notes 2 and 3	

3. Using a hammer, tap the preassembled anchor through the object being anchored into the hole. The anchor should be seated firmly against the base plate. Note: do not expand the anchor by hand before tapping it into the hole.

4. Tighten bolt or nut to the specified torque, using a torque wrench.

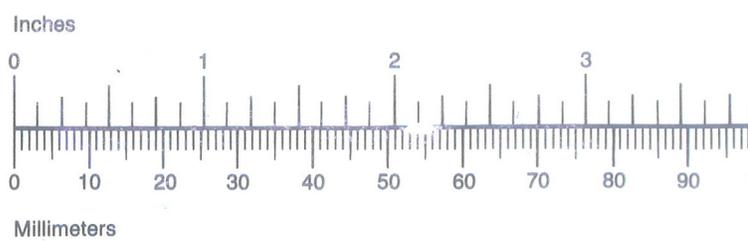
Note: When using an HSLB anchor no torque wrench is required. The torque cap shears off at the specified torque value.

		Ultimate Loads (lbs.)					
		Concrete Strength (psi)					
		4000		5000		6000	
PT (mm)	max. thickness fastened						
L (mm)	anchor length						
h (mm)	head height + washer	Shear	Tension	Shear	Tension	Shear	Tension
M (ft.-lbs.)	max. tightening torque	7520	5870	8345	6545	8610	7220
Max. gap (mm)		2480	8500	13220	9700	13960	10900
Wrench Size (mm)	HSL/HS HSLB	7570	11240	18900	12920	20390	14600
DC (mm)	clearance hole	10890	20205	33640	22960	36390	25710
W (mm)	washer dia.	19010	25500	45020	27975	48110	30450
BMT (mm)	min. base material thickness	5310	34390	62615	39835	68790	45280
Drill bit							
Hammer Drill							
		Allowable Loads (lbs.)					
		Concrete Strength (psi)					
		4000		5000		6000	
		Shear	Tension	Shear	Tension	Shear	Tension
		2155	1680	2390	1875	2470	2070
		3580	2435	3790	2780	4000	3125
		5040	3220	5420	3700	5845	4185
		8855	5790	9645	6580	10430	7370
		1180	7310	12905	8020	13790	8730
		5855	9860	17950	11420	19720	12980
		21490					

The HSL Metric Anchor Spacings and Edge Distances are Calculated Using the Following Formulae:

		Anchor Spacing			Edge Distances		Shear	Tension	Shear	Tension	Shear	Tension	Shear
		AS	AS _{min}	f _{AS}	ED	ED _{min}	2155	1680	2390	1875	2470	2070	2545
HSL		3.0E	1.0E	0.7	2.5E _{min}	1.0E _{min}	3580	2435	3790	2780	4000	3125	4215
							5040	3220	5420	3700	5845	4185	6270
							8855	5790	9645	6580	10430	7370	11220
							1180	7310	12905	8020	13790	8730	14675
							5855	9860	17950	11420	19720	12980	21490

Metric Ruler



Example: HSL-GR M 12/25
This is a stud HSL anchor. The anchor material is type 316 Stainless Steel. The thread size is 12 mm and this anchor can attach up to a 25 mm thick plate.

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