ADHACO HARDWARE

STRUCTURAL ANALYSIS AND COMPUTATIONS
FOR INDIVIDUAL
ADHACO VERTICAL BLAST LATCH AND KEEPER
TYPE - H-111

The following analysis and computations indicate the key phases of the stuctual strength of the adhaco Type H -111 Vertical Blast Latch and Keeper.

The vertical latch listing belts are computed on a yield tensile and compressive strength of 132,000 psi and on an assumed conservative shear yield strength of 66,000 psi. These values are based on cold finished rounds conforming to A1S1 4040-42. The 132,000 psi is minimum yield stress of the material while the 60,000 psi is an assumed value based on the yield strength. The elongation is 16% in two (2) inches.

All castings are grade A malleable iron, grade 3510, conforming to ASTM A -47-52.

Physical properties of the grade 35018 malleable iron are:

Tensile strength:	53,000 psi
Yield strength	35,000 psi
Elongation in 2 inches:	18%
Shear strength:	48,000 psi
Yield shear strength:	23,000 psi

Considering the dynamic effects, the castings are computed at 40,000 psi and 20,000 psi.

TWo types of cap screws are used for mounting componets. Latch Bolt Keepers are retained by high strengh socket head cap screws. For the sokcet head cap screw a tensile strength of 70,000 psi and a shear strength of 35,000 psi are used. Latch Bolt Guides are retained by type A-325 hex head cap screws. For the A-325 bolts, a tensile strength of 50,000 psi and shear strength of 30,000 psi are used.

The top and bottom vertical sliding latch bolts are essentinally identical and will be considered herein. The vertical latches are made up of three parts: The latch bolt keeper, the latch bolt, and two latch bolt guides. The vertical latches need resist only negative loads and hence they will be analyzed only for the loading.

it is assumed for the purpose of analysis that the Latch Bolt Keeper is contacted by the latch bolt along the center line of the holes used for attaching the keeperto the frame. This assumption is noted here since it influences the design of both the keeper and the latch bolt.

LATCH BOLT KEEPER:

The ½ inch diameter cap (socket head) screws have a capacity of.142 (700000) = 9940 lb. each for a total of 19,900 lbs.. The oustanding legs of the casting must transmit this load. The plastic bending moment of the legs:

$$M_p = (11/16)^2 \frac{(2)(40000)}{4} = 9440 \text{ lb. in.}$$

Taking the moment arm from the end of the fillet and considering both legs, this is equivalant to a load of:

$$\frac{27}{32}\frac{P}{2} = 9440$$

$$P = 23{,}000 \text{ lb.}$$

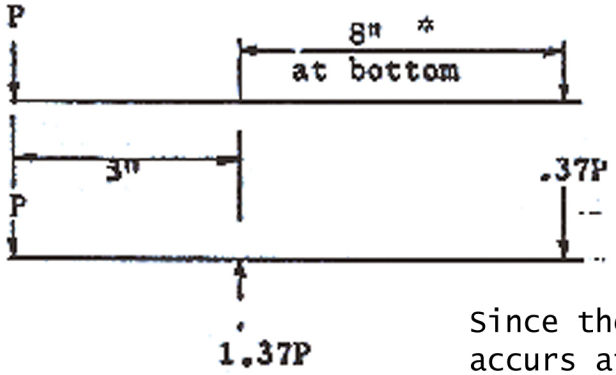
The walls of the keeper are 3/8 inches thick considering a 1 inch length to be effective, this is equivalent to a load of:

$$\frac{3}{8}(1)(40000)(2) = 30{,}000 \text{ lb.}$$

The limit, therefore, is dependent on the strength of the cap screws and, therefore, the total capacity is 19,900 lb..

Latch Bolt Guides:

The Latch Bolt Guides are loaded by bending of the slide latch bolt.



* (10 ¼ for top) Since the 8" dimension (which accurs at the bottom) is more servere, that value will be used.

Since the Latch Bolt Guide closest to the keeper is being foced against the door, it offers no problem. The guide furthest from the keeper must be checked. The two ½ "diametere hex head cap screws have total capacity of (2)(.142)(50,000) = 14,200 lb.. The oustanding legs on the castings are 2 inches wide and 5/8 inches thick. The Plastic moment is:

$$Mp = \frac{(5/8)^2 \ (2) \ (40000)}{4} = 7820 \text{ lb. in.}$$

The moment arm is 1 3/8 inches, thus the associated raction is:

$$\frac{7820}{1.375} = 5680 \text{ lb.}$$

The "as cast" relief area under the casting reduces the thickness to ½ inch for width of inches. The modified reaction is:

$$\frac{3/4}{2} \times 5680 + \frac{1\frac{1}{2}}{2} \times 5680 \times \frac{(\frac{1}{2})^2}{(5/8)^2}$$

$$2130 + 2270 = 4,400 \text{ lb.}$$

The total resistance is 2 x 4400 = 8800 lb.. in terms of P this is:

$$.37 P = 8800$$

$$P = 23,800 \text{ lb.}$$

<u>Sliding Latch Bolt:</u>

The shear area is:

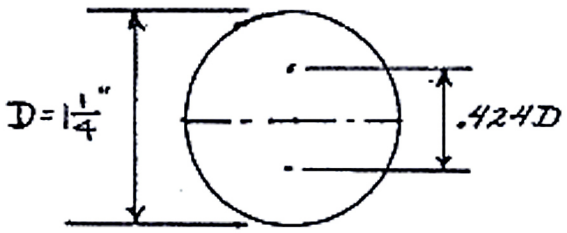
$$(1\frac{1}{2})^2 \ \frac{\pi}{4} - 1/4(3/16)$$

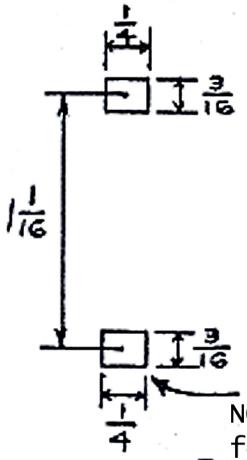
$$1.227 - .047 = 1.18 \text{ sq. in.}$$

Considering only shear the total capacity would be:

$$1.18 \ (66,000) = 78,000 \text{ lb.}$$

The plastic moment is:





NOTE: This is added for symmenty but is conservative

$$Mp - 132{,}000 \left[\frac{\pi D^2}{8} (.424D) - (3/16)(1/4)(1\ 1/16) \right]$$

$$= 132{,}000 \left[\frac{\pi}{8} (1\tfrac{1}{4})^3 (.424) - (1/4)(3/16)(1\ 1/16) \right]$$

$$= 132{,}000 \left[.325 - .055 \right]$$

$$132{,}000\ (.270) = 35{,}700 \text{ lb. in.}$$

This is associated considering a moment arm of 3 in. (center to center of mounting bolts) with a P of:

$$3 = P = 35{,}700$$

$$P = 11{,}850 \text{ lb.}$$

CONCLUSION:

The strength of the individual vertical latch under negative loading is , therefore, limited by the sliding latch bolt to 11,850 lb