SAMUS COUNTER LIFTING

FIXTURE

D-ZERO ENGINEERING NOTE #3740.000-EN-494

Herman J. Stredde

May 27, 1998

Approved: _____

Kurt Krempetz, PPD/ETI/D0 Upgrade/Mechanical Group Leader

FIXTURE TO BE USED FOR HANDLING/LIFTING OF
SAMUS MUON CHAMBERS.

A lifting fixture has been designed to handle the Samus counters. These counters are being removed from the D-zero area and will be transported off site for further use at another facility. This fixture is designed specifically for this particular application and will be transferred along with the counters.

The future use of these counters may entail installation at a facility without access to a crane and therefore a lift fixture suitable for both crane and/or fork lift usage has been created. The counters weigh approximately 3000 lbs. and have threaded rods extended through the counter at the top corners for lifting. When these counters were first handled/installed these rods were used in conjunction with appropriate slings and handled by crane. The rods are secured with nuts tightened against the face of the counter. The rod thread is M16x2 (~.625" dia.) and extends 2" (on average) from the face of the counter. It is this cantilevered rod that the lift fixture engages with "C" style plates at the four top corners. The strongback portion of the lift fixture is a steel rectangular tube 8" (vertical) x 4" x .25" wall, 130" long. 1.5" square bars are welded perpendicular to the long axis of the rectangular tube at the appropriate lift points and the "C" plates are fastened to these bars with 3/4-10 high strength bolts -grade 8. Two short channel sections are positioned-welded- to the bottom of the rectangular tube on 40" centers, which are used as locators for fork lift tines. On the top are lifting eyes for sling/crane usage and are rated at 3500 lbs. safe working load each—VERTICAL LIFT ONLY!

The fixture has been designed in accordance with ANSI/ASME B30.20-1985, Standard for Below-The-Hook Lifting Devices. This standard requires a safety factor of three based on the yield strength of the material on all components.

Component Data:

8 x 4 x .25 wall steel tube, $f_y=46$ KSI, $f_a=46/3=15.33$ KSI
 $I_{xx}=45.1$ in⁴, $I_{yy}=15.3$ in⁴, $S_{xx}=11.3$ in³, Area=5.59 in²
 Hanger Bars, Low Carbon steel, $f_y=30$ KSI, $f_a=30/3=10$ KSI
 $I_{xx}=I_{yy}=0.422$ in⁴, $S=0.5625$ in³, Area=2.25 in²
 "C" plate, Low Carbon steel, $f_y=30$ KSI, $f_a=30/3=10$ KSI
 $I_{xx}=0.837$ in⁴, $S_{xx}=0.705$ in³
 Bolts, Grade 8 steel, $f_y=120$ KSI, $f_a=120/3=40.0$ KSI

Rectangular Tube (Fig. 1)

Max. Moment=45 x 1500=67,500 lb.-ins.
 Bending stress, $f_b=M/S=67,500/11.3=5973$ psi < 15.33 KSI
 Shear stress, $f_s=1500/5.59=268$ psi < 15.33 KSI
 Deflection @ ctr $=(Pa/24EI)(3l^2-4a^2)=0.092"$

Hanger Bars (Fig. 1)

Max. Moment=Pl=4.125 X 750= 3100 psi
 $f_b=3100/0.5625=5511$ psi < 10 KSI
 deflection @ end=PL/3EI=0.0015"

Bolts

Max. Moment=.375 x 750=281 lb-ins.
 $F_b=(281 \times .375)/.015=7,025$ psi < 40KSI
 Shear stress=750/.302=2500 psi
 Bearing Stress=750/ (.75 x .75)=1333 psi

"C" plates(Fig. 2)

Max. stress = $P/a + Mc/I = 750/(2.5 \times .75) + (1.625 \times 750)(1.25) / 0.837 = 2220$ psi < 10 KSI
 Tear out through bolt hole to top of "C" plate=750/(1.375 x .75)=727 psi

This lifting fixture will be load tested to 1.25x rated load of 3000 lbs.—3750 lbs. The test will include lifts at the fork lift location as well as the points where the crane picks are made.

SECTION B-B

SECTION A-A

FIGURE 1

FIGURE 2