SLAC Lifting Fixture Load-rating Form
(See page 2 for General Guidelines and Step-by-step Process)

Requester
Print name H. James Krebs Date 10/12/05

Brief Description of Lifting Fixture and object to be lifted
Backward End Plug Lift Pads

SLAC Drawing number SK-HJK-110504
Copy of drawing or sketch must accompany this form.

1. Rated Capacity Calculation

Rated capacity 4800 lbs
Print name H. James Krebs Signature H. James Krebs Date 10/12/05
Qualified engineer who performed calculations. Copy of calculations or vendor documentation must accompany this form.

2. Non-destructive testing of load-bearing welds (pre-2005 non-certified welds only)

Print name N/A Signature Date
Qualified engineer who supervised or contracted testing. Copy of report must accompany this form.

3. Review by Hoisting & Rigging Safety Committee

Print name H. James Krebs Signature Date
H&R Safety Committee Chair

4. Load testing - normally at 125% of rated capacity (see instructions).

Required test weight 6,000 lbs Actual test weight 6,000 lbs Successful completion (check) ✓
Print name DAVID B. ENGERSER Signature Date 06/19/06
SLAC Rigging Department

5. Label fixture with rated capacity & S/N

Assigned S/N BBR-021 thru BBR-024
Crane Custodian or Line Supervisor responsible for fixture
Print name H. James Krebs Signature H. James Krebs Date 10/12/05

6. Final Inspection and Approval

Print name SLAC H&R Inspector Signature Date

7. Permanent record keeping - retained for the life of the equipment (see instructions).
BABAR ENGINEERING NOTE
BACKWARD END PLUG LIFT PAD (BBR-021 thru BBR-024)
CALCULATIONS OF RIGGING LOADS

1.0 Loads (as measured on 11/29/04):

BWD End Plug
16,500 lbs

2.0 Background:

The backward end plug, lead horseshoe and magnetic shield cylinder are removed or installed per procedure AP-350-990-05. The BaBar Chief Mechanical Engineer, Technical Support Supervisor, and EFD Rigging Crew all have total confidence in the robustness of the existing system.

The end plug is lifted using four custom engineered lift pads that bolt directly to the plug itself using four Grade 8 socket head cap screws x 2.5” lg. per each pad. The design of these lift eyes is shown in Sketch SK-HJK110504-1. Each lift pad has a 15,000 lb capacity swivel hoist ring bolted to it.

3.0 Bolt Loads:

Tension: For purposes of assumption, the allowable bolt loads for a Grade 8 AISI bolt equal that of ASTM A490. According to the AISC Manual of Steel Construction, Allowable Stress Design, Ninth Edition, Section 4-3, the allowable tensile load per bolt is 32.5 kips. The actual load per bolt is:

\[
16,500\text{ lbs}/4\text{ pads}/4\text{ bolts per pad }= 1,031\text{ lbs per bolt}
\]

Therefore, the factor of allowable redundancy is:

\[
32,500\text{ lbs}/1,031\text{ lbs} = 31.52
\]

Shear: There is a shear load on the bolts. For purposes of assumption, the allowable bolt loads for a Grade 8 AISI bolt equal that of ASTM A490. According to the AISC Manual of Steel Construction, Allowable Stress Design, Ninth Edition, Section 4-5, the allowable shear load per bolt is 16.8 kips. This is based on a bearing type connection with the bolt threads included in the shear plane. Based on measurements of the actual sling angles, the X component of the load is:

\[
17\text{ in} \times (16,500\text{ lb}/4)/30\text{ in} = 2338\text{ lb}
\]
Therefore, the factor of allowable redundancy is:

\[
\frac{16,800 \text{ lbs}}{2338 \text{ lbs}} = 7.19
\]

4.0 Lift Pad Shearing Load:

The material of the lift pad is 12L14 steel which has a 60 ksi yield and a 78 ksi tensile. The shear area of the lift pad is:

\[
1.059'' \times 3.937'' \times \pi = 13.098 \text{ in}^2
\]

If one assumes the entire load is taken in shear, the shear stress in the lift pad equals:

\[
\frac{16,500 \text{ lbs}}{4/13.098 \text{ in}^2} = 315 \text{ psi}
\]

According to the AISC Manual of Steel Construction, Allowable Stress Design, Ninth Edition, Section 5-49, the allowable shear load is 0.40 \(F_y\). Therefore, the factor of redundancy is:

\[
\frac{60,000 \text{ psi} \times 0.40}{315 \text{ psi}} = 76.2
\]

Prepared by: H. James Krebs

Signature: [Signature]

Date: 11/1/04

Reviewed by: Zohrab Vassilian

Signature: [Signature]

Date: 11/1/04
4,125 lbs.

SK-HJK110501 BWD END PLUG LIFT PAD RIGGING LOAD