February 29, 1996

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Energy Related Inventions Program
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Subject: Technical Progress Report No. 16
Hydraulic Test Unit and Plugs
Grant No. DE-FG01-90CE 15398

Gentlemen:

Please find our subject Technical Progress Report for 4th quarter period 1995 (October 1, 1995-December 31, 1995) detailing activities carried out per respective grant projected tasks.

TASK I

Based on the revised layout shown on detail drawings submitted in TPR No. 15, an order was issued for fabrication of the "roll bar" support structure to Coventry Manufacturing Co. Additional aluminum flat stock material was purchased to support the hydrotest system components within the roll bar structure which was subsequently received and checked. Remaining activity for Task I is to re-use system components previously purchased and to install them in the new more compact and lighter weight structure. The system shall be tested and checked upon completion.

TASK II

No reportable activity took place for this task during this period.
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TASK III

Based on the encouraging results, (as reported in TPR No. 15) of test trails related to the initial prototypes of the Model Beta mechanical seal plug in 204 seal size range made of brass material construction, we planned to select (3) different sizes of standard fasteners in (3) different materials to further check the validity of this new approach. Initial design sketches provided the basis for generation of plug component dimensions details which were eventually listed in spread sheet format drawing. Assembly drawings for both single and double seal configurations were also made and are herein attached. These (3) drawings are of course considered preliminary at this time.

Sizes and materials initially selected for fabrication are as follows:

<table>
<thead>
<tr>
<th>Seal Size</th>
<th>Plug Range</th>
<th>Material</th>
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</thead>
<tbody>
<tr>
<td>1. 202</td>
<td>(.480-.540)</td>
<td>Stainless Steel, Type 304</td>
</tr>
<tr>
<td>2. 204</td>
<td>(.600-.600)</td>
<td>Commercial Brass</td>
</tr>
<tr>
<td>3. 206</td>
<td>(.720-.780)</td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>4. 314*</td>
<td>(1.160-1.230)</td>
<td>Stainless Steel, Type 304</td>
</tr>
</tbody>
</table>

*NOTE:* This larger size was selected, as it was coincidentally related to an actual inquiry received from Duke Power, Catawaba Nuclear Plant during this period. Duke Plant engineers agreed to try (4) of these Model Beta plugs in their steam surface condenser where they had experienced problems with the existing plugging devices. This was of course contingent on testing results of the prototypes.

Orders were issued for the 204 brass and the 314 stainless steel double seal designs. The window of opportunity afforded by the Duke condenser trial forced us to concentrate on this particular size for the remainder of this reporting period. Fabricated parts were received and checked for both brass and stainless steel plugs. Utilizing test pieces from our stock requiring only minor modifications, the size 314 stainless steel Beta plug was put through a series of test trials. Summary of results is as follows (see actual test trial worksheets attached).

1. Initial trials in a stainless steel test piece (size 1.240" I.D.) proved the plug would only hold up to 1,500 psig before it would extrude in shell side direction. **Please Note:** Size 314 O-ring seal at rest is 1.145" O.D. requiring close to .100" squeeze.
2. With some modifications to components, i.e.

   a. Reducing wedge ring length.
   b. Machining flats on bolt body in lieu of using screw driver slot which proved insufficient for a plug size this big.
   c. Single seal compression.
   d. Utilizing thrust bearings on nut to washer interface.

The Size 314 plug was repeatedly retested in same test piece as in Step No. 1 with no improvement of results - 1,500 psig maximum.

3. Tests were again repeated after the initial test piece I.D. of 1.240" was thought to be too excessive in radial clearance with regard to O-ring 1.145 O.D. Another stock test piece was modified to 1.210 I.D. (reducing squeeze required to .065"). Results were much better as plug could withstand approximately 3,000 psig before plug extraction. Plug jaw teeth edges, however would shear as plug moved out.

4. Last tests were made after jaw sections were re-heat treated/rehardened to Rockwell C-60 for better grip in stainless steel test piece. Utilizing the 1.210" test piece the plug held to 2,000 psig with no problems encountered. We did not attempt to go higher at this time since we did not want to shear the last set of good jaws available.

Since these size 314 plugs were planned for trial use at Catawba Nuclear Station, (condenser application design pressure of full vacuum to 75 psig), Duke Power Engineers agreed to install (4) samples sent November 6, 1995 at the next outage opportunity. (See photo enclosed.)

Plans were made for the fabrication of the other selected sizes and material Beta plugs for testing next reporting period.

This concludes our TPR No. 16, should there be any questions, please do not hesitate to call.

Yours truly,

Michael Catapano
President

MC/bc
Jaws - Do not remove to dock use 0.60 in high.

1st Test that:

Take up to 1000 psi - Hour OK.

Do Not Go Higher - Get er of good Jaws.

Get low often when -
Sone County - 1050 psi plug w 1.50 cu

Add sink down to 25 then for up 1.150 cu w 1.20 cu

Took to 500 psi / ok

" up to 1600psi, ok

Up to 2000 " o.k.

2,000 -

2,200 -

OK - 2 rinses

Due to show water angle

in Alash County, Limit on other old gypsum

#414 5%alc

1.75

0.10 \( \times \) (210 x 2)

\[ \frac{1.145}{0.8} \]

= 1.210

-> Maybe lower if Mah Booth Ptolemy

And Hansen

The Rockwell C 60

L.H.
CRes 0.8 1.145

c - 1.180" o.d.

c - 1.160" o.d.

1. 180 Res. SHE S.S.

Double End Flange.

C Res

0.8 1.145

c - 1.180" o.d.

Vans - 1.140" o.d.

Thread Size - 1500 psi, max.

No Multiple Threads = 1500 psi, max. - Plug 1/2" NPSG.

Washers Not Gny. - ?

Check Threads - Remove - Weaker Rib Length - Put Stearins on Flare - Body - Steel Shim Star N.G. in N.G. Big Size

10/30 11/5 1971

Repeat Threads - 1500 psi, max.

Check - Van Hughes. Both Cut c.k. - Fit LH

C 1/80.55 Rockwell - o.k.

May be 1.210 too high'.

Modify 1.120 Flare per to 1.210" S.A.
1/16" SLOT 1/8" DEEP

END VIEW

CUT INTO 4 EQUAL PARTS AFTER MACHINING IS COMPLETED

1/32" MAX. SAW CUT

WEDGE JAW & GROOVE

WEDGE RING

SECT. "II-II"

SECT. "I-I"

(.600 THRU .960)
SECT. "I-I"

1.480 THRU .600

NOTE: FINISH ALL SURFACES BETWEEN 32 & 65 RMS.

COMPRESSION RING

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PARTS LIST

1. BODY
2. COMPRESSION RING
3. SEAL "O" RING
4. WEDGE RING
5. WEDGE JAW & GROOVE
6. WEDGE JAW RETAINER SPRING
7. WASHER

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<th>PLUG SIZE</th>
<th>SEAL &quot;O&quot; RING</th>
<th>TUBE SIZE</th>
<th>WEDGE TEETH</th>
<th>BODY</th>
<th>WEDGE J.</th>
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**ALMA MODEL**

**MECHANICAL SEAL PLUG**

**STOCK DETAILS**

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