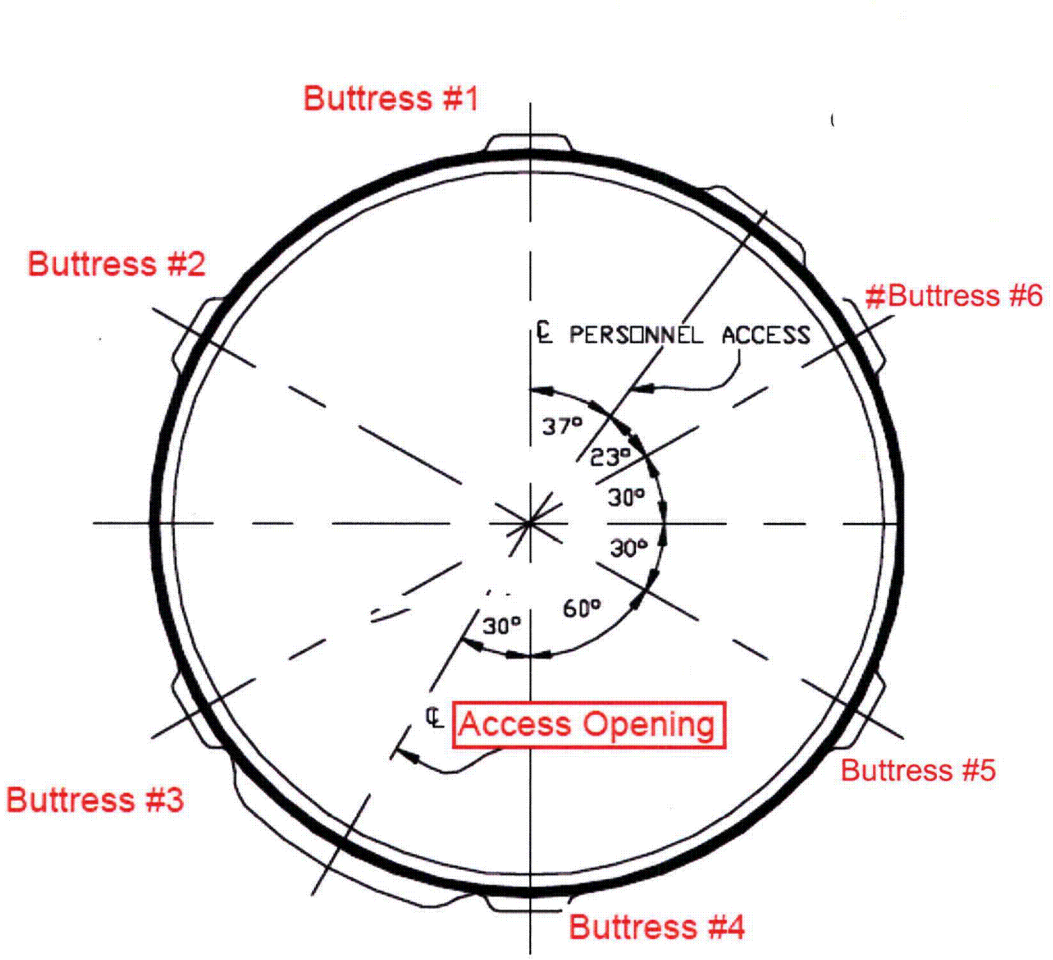
NORTH
Buttress #1
Buttress #2
#Buttress #6
℄ PERSONNEL ACCESS
37°
23°
30°
30°
60°
30°
℄ Access Opening
Buttress #3
Buttress #5
Buttress #4

"Holliday, John" <John.Holliday@pgnmail.com >
05/08/2007 01:15 PM

To <javad.moslemian@sargentlundy.com>, <CHRIS.A.SWARD@sargentlundy.com>, <CHI-HOLT.KO@sargentlundy.com>
cc "Jopling, Daniel L." <DANIEL.JOPLING@pgnmail.com>
bcc
Subject FW: Request for Information - HTS loads after SG replacement

Javad,
As you can see from the e-mail below from Keith Henshaw the heaviest load is 527,000 lbs.....a lot more than we thought. Per Steve Roe (Task Manager for large bore piping) the hot leg and its lifting fixture is 76,000 lbs.

Regards,

John H.

-----Original Message-----
From: Henshaw, Keith
Sent: Tuesday, May 08, 2007 12:43 PM
To: Holliday, John
Cc: Jopling, Daniel L.
Subject: FW: Request for Information - Please answer as soon as practical

The heaviest object by far loading the shell after SG movement is the Auxiliary Crane. See e-mail below. Weight is 527,300 lbs.

Keith
-----Original Message-----
From: Tiel, Leon van [mailto:leon.van.tiel@Mammoet.com]
Sent: Tuesday, May 08, 2007 5:02 AM
To: Henshaw, Keith
Subject: RE: Request for Information - Please answer as soon as practical

Keith,

The aux crane is indeed the heaviest item going over the HTS, other than the SGs. Your lifted load might be a little conservative. TLD-03 rev02 sheet 2 shows 40.000 lbs.

Leon

From: Henshaw, Keith [mailto:Bryan.Henshaw@pgnmail.com]
Sent: 07 May 2007 21:27
To: Tiel, Leon van
Subject: Request for Information - Please answer as soon as practical

Leon,

As you know, Sargent & Lundy is working on the containment analysis. They are unable to qualify the

Calculation No. S06-0005
Revision 0
Attachment 269
Page 7 of 7

containment shell with tendons detensioned, and with the load of a full steam generators moving in and out of containment. For this reason, they will not detension the tendons until after the Steam Generators are moved. They will then attempt to qualify the containment shell for the lighter non steam generator loads. They asked for assistance in identifying the largest loads (SGs not included) that will be placed on the HTS and pass over the shell.

I first thought of the TLD. From review of TLD03, it appears that the largest TLD load is approximately 38 US tons (hang basket). The gantry and hang basket weight a combined 71 US tons, but they pass over the shell in two pieces. Let me know of any items that you are aware of that are heavier.

I also thought of the Auxiliary Crane, which is much heavier than the TLD components.
Crane Weight w/ Rear Counterweights 116,500 lbs
Side Counterweights - 330,000 lbs
Pedestal Extension - 2000 lbs
Lifted Load (Header Beam and Rigging) - 60,000 lbs
Aux Crane Cart - 12,800 lbs
Impact Load (10% of Lifted Load) - 6000 lbs

Total Aux Crane weight with counterweights is approximately 527,300 lbs.

Note: When aux crane cart design is complete in mid July 2007, the counterweight total may be reduced to around 220,000 lbs, **if possible**. This would reduce overall weight to 527,300 lbs - 110,000 lbs = 417,300 lbs. **For now, use 527,300 lbs**, but be aware that there is an effort ongoing on our part to reduce the counterweight total.

Leon - I intend to forward this on to S&L after running this by you. Are you aware of anything heavier that we need to be concerned with.

Keith Henshaw

Record of Lead Review

Document: Dr. Howard Hill shear stress calc for anchorhead **Revision 0**

The signature below of the Lead Reviewer records that:
- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☒ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday J Holliday Civil 09-03-08
Lead Reviewer (print/sign) Discipline Date

Item No.	Deficiency	Resolution
	NONE This calculation is conservative. Allowable shear stress could have been taken as 0.4 x 90ksi (yield strength) =36 ksi vs 35 ksi used in the calculation	

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

Shear Stress in Anchor Head at 0.74 F_{pu} Tendon Seating Force

Howard T. Hill, P.E.

The critical stress I the anchor head is the shear stress in the web segments between wire holes. The following calculation determines the maximum shear stress in web segments when a tendon is stressed to the maximum allowable load of 0.74 times specified ultimate tensile strength.

1. Maximum Wire Force

CR3 tendons consist of 163 @ 7 mm diameter wires. Tendon area, A_t, is:

$$A_t = 163 \times \pi \times 7^2 / 4 = 6{,}273 \text{ mm}^2 = 9.723 \text{ in}^2$$

Specified minimum ultimate strength, σ_{pu} of the wire is 240 ksi. Tendon force, F_{74} (=0.74 GUTS), with wire stress at 0.74 σ_{pu} is:

$$F_{74} = 0.74\ \sigma_{pu} \times A_t = 0.74 \times 240 \times 9.723 = 1{,}727 \text{ kip (rounded up for conservatism)}$$

Corresponding force per wire (maximum wire force), F_{wmax}, is:

$$F_{wmax} = 1{,}727 / 163 = 10.6 \text{ kip (rounded up for conservatism)}$$

2. Web Shear Stress

The attached drawing shows a symmetric quadrant of an anchor head. The minimum spacing between adjacent holes is 0.433 / cos 30° = 0.500 in. Maximum hole diameter is 0.290 + 0.010 (positive tolerance) = 0.300 in. The corresponding minimum length of

the web segment between holes is 0.500 – 0.300 = 0.200 in. Minimum web segment area is 0.200 x 6 (anchor head thickness) = 1.2 in^2.

The anchor head drilling pattern consists of a center hole surrounded by 7 concentric hexagonal rings with holes and interconnecting web segments. The rings are numbered 1 (innermost) thorough 7 (outermost) to facilitate the following discussion. The outer (7^{th}) ring is missing the 6 holes at the hexagon vertices. For purposes of calculating loads and web shear stress, it is conservatively considered to pass through the holes at the vertices of the 6^{th} ring.

Ring web area is the sum of the areas of the individual web segments between holes. The shear load acting on the web of a ring is the sum of the load imposed by wires passing through holes that are completely within the ring and half of the load imposed by wires passing through the holes in the ring itself.

The following table gives the web areas and loads associated with each of the 7 rings.

Parameter	Ring						
	1	2	3	4	5	6	7
Perimeter Holes, N_{hp}	6	12	18	24	30	36	42[1]
Ring Web Segments, $N_{wp} = N_{hp}$	6	12	18	24	30	36	42
Web Area, $A_w = 1.2 \times N_{wp}$, in^2	7.2	14.4	21.6	28.8	36	43.2	50.4
Holes Enclosed (see Dwg.), N_1	1	7	19	37	61	91	121
Perimeter Holes / 2, $N_2 = N_{hp} / 2$	3	6	9	12	15	18	21
Loads Acting on Ring, $N_n = N_1 + N_2$	4	13	28	49	76	109	142
Loads / Web Area, $N_L = N_n / A_w$,	0.556	0.903	1.296	1.701	2.111	2.523	2.817
Note 1: Includes 6 holes at the vertices of ring No. 6							

The greatest load to area ratio, N_L, is on Ring No. 7. Therefore, the web segments on this ring are the critical areas for shear stress.

Maximum shear stress, τ_{max}, in the ring No. 7 web is:

$$\tau_{max} = F_{wmax} \times N_L = 10.6 \times 2.817 = 29.9 \text{ ksi}$$

3. Acceptability of Shear Stress in Anchor Head

ACI 318-05 limits stress in anchorage components to 0.70 f_{pu}, where f_{pu} is the ultimate tensile strength of the material. The ACI does not set a separate limit on shear stress. The minimum specified ultimate tensile strength of the anchor head material is 100 ksi. Conservatively considering the shear strength, τ_u, to be half of the tensile, and applying the ACI limit on tensile stress to shear stress, results in the following.

$\tau_u = 100 / 2 = 50$ ksi

$0.70\ \tau_u = 0.70 \times 50 = 35$ ksi

The maximum shear stress, 29.9 ksi, in the anchor head is less than the 35 ksi allowable. Therefore, a tendon force of 0.74 GUTS is acceptable with respect to anchor head stress.

Record of Lead Review

Document BPI Installation and Inspection of Swaged Splices **Revision 0**

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☐ **Design Verification Review** ☒ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday	John Holliday	Civil	8/26/2008
Lead Reviewer	**(print/sign)**	**Discipline**	**Date**

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

BarSplice PRODUCTS INC.
SUBSIDIARY OF FC INDUSTRIES, INC.

4900 Webster Street
Dayton, OH 45414
Telephone: 937 275-8700
Fax: 937 275-9566

INSTALLATION AND EXAMINATION OF SWAGED MECHANICAL SPLICES

SUPPLEMENTAL REQUIREMENTS FOR THE CRYSTAL RIVER NUCLEAR POWER PLANT

REVISION LEVEL 0
AUGUST 18, 2008

*This document has been prepared by BarSplice Products, Inc., "BPI", for **Progress Energy Florida**. The purpose of this document is to address quality control requirements for the installation and examination of swaged mechanical splices proposed for use on the **Crystal River Nuclear Power Plant**. Headings hereunder are keyed to ASME Section III, Division 2, CC-4333.3, "Requirements for Production Splicing Procedures", subsection (c), items (1)-(8). This document is SUPPLEMENTAL to standard splicing instructions that appear in BPI-Grip™ Systems Splicing Manuals. The product to which this document refers is the **BARGRIP XL** series of mechanical coupler. This document may be revised and re-issued by BPI in response to customer questions, technical changes, product changes, errors, omissions, and other reasons that may be appropriate.*

1. **Cleanliness requirements**

   At the time of swaging, portions of reinforcing bars to be placed inside the coupler sleeve should be free from mud, loose mortar, oil, or other nonmetallic coatings; in the same condition as they would be for a concrete pour. Reference ACI 318-08 Section 7.4.1.

2. **Type of equipment and methods used for swaging**

   The equipment comprises of an electric or gasoline-driven hydraulic pump, a hydraulic hose, and a hydraulic press fitted with a swaging die set.

   The methods used for swaging are as detailed in BPI-Grip™ Systems Splicing Manual and Operating Instructions, *SM01, SM02 or SM21.*

3. **Required swaging pressure, method of measurement, pressure tolerance and frequency of calibration of the hydraulic system (gauge calibration)**

   The required swaging pressure is 10,000 psi. Pressure is verified by means of a calibrated pressure gauge provided by BPI. The acceptable pressure range, indicated by the calibrated pressure gage is 10,000 psi minimum to 10,600 psi maximum.

   Accuracy of the pressure gage reading is plus or minus (+/-) 300 psi. If a pressure gauge develops an error of more than 300 psi at 10,000 psi, it is not used by BPI. Pressure gauges are checked and calibrated against standards traceable to NIST before they are shipped from BPI to the project site for use. A serial number will be found on each pressure gauge. A calibration sheet for each serial number is kept on file at BPI.

   The calibration frequency of the pressure gauge is annual. In the event that the pressure gauge becomes damaged while in use, re-calibration should be performed immediately, or the pressure gauge should be exchanged.

4. **Method used to verify final alignment and engagement of the coupler on both bars, including tolerances**

   Final alignment of the reinforcing bars shall be at the discretion of the Field Engineer.

   When mechanically splicing bars of the same size, each reinforcing bar should nominally be inserted halfway into the coupling sleeve. Each bar should be marked for proper insertion. An "inspection mark" made on the bar before swaging, a known distance from the bar-end, can be used to verify final engagement.

   Normal reinforcing bar insertion (engagement) tolerance is plus or minus (+/-) ½ d_b per bar, where d_b = nominal reinforcing bar diameter. A centrally disposed gap between the bar ends equal to 1 x d_b is acceptable. Larger gaps may be acceptable if performance is verified by testing the condition.

5. **Bar end preparation**

Reinforcing bar ends may be shear cut, flame cut, saw cut or cut by means of an abrasive cut-off wheel. Bar ends should remain straight at the time of cutting; excessive shear lips or flame-cutting slag (if any) that hinders reinforcing bar insertion into the coupler should be removed.

6. **Minimum and maximum number of swaging operations per sleeve**

The minimum number of swaging operations per sleeve, "bites", is shown in BPI-Grip™ Systems Splicing Manual.

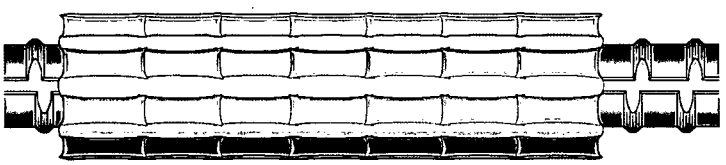
The maximum number of bites per sleeve, as a matter of practicality, should not normally exceed the minimum number of bites per sleeve by more than 50 percent.

7. **Method used to ensure sleeve is swaged along full length**

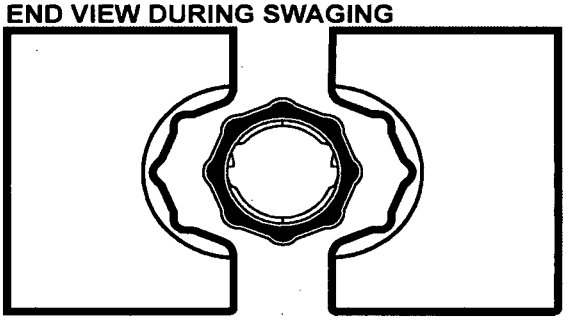
Visual inspection shall be used to verify that coupling sleeves are swaged along their full length. The shape of a coupling sleeve before swaging is plain-round. The appearance of a coupling sleeve is visibly altered by the application of bites. The imprint of each bite is octagonal. When a coupling sleeve has been fully swaged along its length, no plain-round portions shall remain.

Example of a coupling sleeve that has been swaged along its full length:

SIDE VIEW AFTER SWAGING



END VIEW DURING SWAGING



8. **Limits of die wear including frequency of checking**

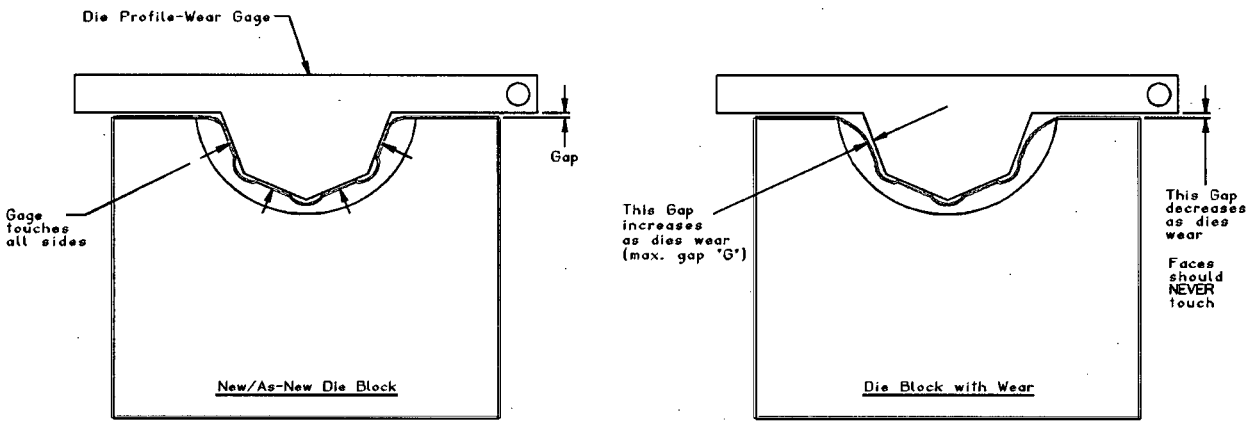
Limits of die wear are as follows:

Reinforcing bar Sizes		Maximum Die Wear, inches (Gap "G" from Die Profile Gage)
US Traditional	US Metric	
#3, #4, #5	10, 13, 16	0.030
#6, #7	19, 22	0.035
#8, #9	25, 29	0.040
#10	32	0.045
#11	36	0.050

Swaging dies are checked for wear by a BPI Technician, by means of a die profile gage, before they are shipped to the project site for use. If dies are worn beyond acceptable limits, they are not sent. Instead, the swaging die profile is re-cut.

Visually inspect dies for damage and/or die wear after every 1000 installed splices. If relatively heavy scoring is observed on the bite area, check the die set with a profile gage or contact BPI for a replacement set. Light scratches are normal and acceptable.

Method used to determine die wear



General Notes and Precautions

Dies should be cleaned periodically to prevent scoring and die wear. Operators should wipe dirt and grit off the swaging bite area at each start up and after the installation of every 20 (approx.) couplers. Operators should always disconnect power to prevent accidental activation of the press during cleaning. Use a suitable penetrating/lubricating agent to get best results. A silicon based release agent such as "Krylon Mold Release" is appropriate. Most liquid soaps and cleaning gels give good results. In addition, if couplers are covered in dirt or grit, wipe their surfaces before swaging.

Die life will be enhanced by routine cleaning and may be decreased by taking insufficient care, particularly in areas where concrete dust is blowing around and sticking to the dies and/or couplers.

Operators should keep die sets together by serial number. Operators should not mix dies of different serial number. Operators should not swage anything other than the correct BPI coupler. Operators should not use the die to perform any other function than the use for which it is intended. Examples: Do not crush reinforcing bars, do not use die for flattening or bending.

ATTACHMENT 2
Sheet 1 of 1
Record of Lead Review

Document BPI Field Splicing Manual (SM01) **Revision 0**

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☐ **Design Verification Review** ☒ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday		Civil	8/26/2008
Lead Reviewer	**(print/sign)**	**Discipline**	**Date**

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-2-10
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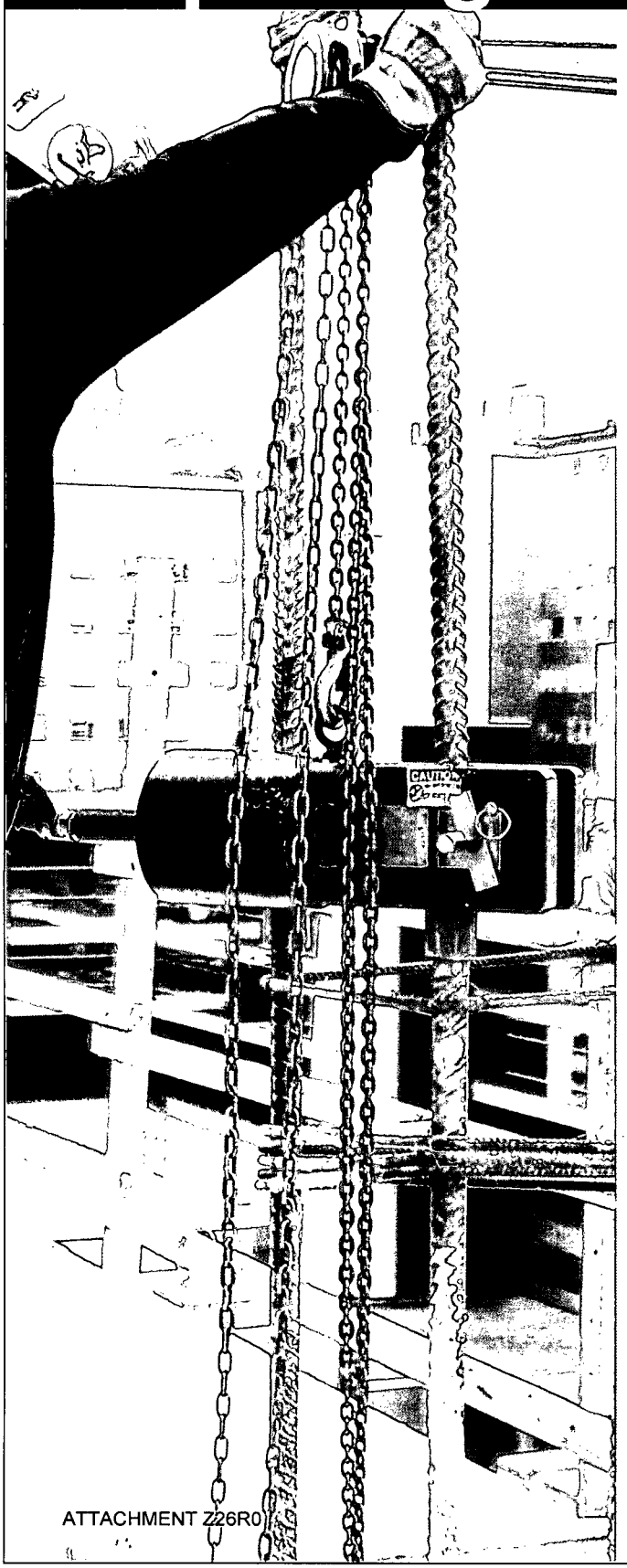
BPI-GRIP™ Systems Splicing Manual (SM01)



ATTACHMENT Z26R0

#3 - #18 Reinforcing Bars

Field Press Models:

BG250
BG400
BG750M
BG1140M

Caution:
Read Carefully

Read this splicing manual, including safety instructions, prior to operating equipment.

BarSplice PRODUCTS, INC.
SUBSIDIARY OF FC INDUSTRIES, INC.

CAUTIONS - READ CAREFULLY

For your safety and for proper installation, before proceeding with splicing or operation or handling of equipment, read and thoroughly understand the instructions in this manual. Retain these instructions for future reference.

DO NOT USE EQUIPMENT FOR ANY PURPOSE NOT DESCRIBED IN THIS MANUAL.
DO NOT USE SWAGING DIES ON ANY PRODUCT NOT SUPPLIED BY BPI.

NOTICE

At the time of printing, the information contained herein is believed to be complete and accurate. Product design changes may occur due to normal development or improvement.

Barsplice Products, Inc., BPI, reserves the right to make changes, design modifications, corrections and other revisions as it sees fit without notice. Check with manufacturer. All products described herein are supplied in accordance with BPI's Standard Terms and Conditions of Sale. Aspects of structural design, evaluation of product fitness for use, suitability or similar attributes are the responsibility of others.

This manual is intended for use by operators, inspectors, and engineers.

Questions should be referred to:

Barsplice Products, Inc.
4900 Webster Street
Dayton, Ohio 45414
USA
www.barsplice.com

TELEPHONE: (937) 275-8700
FAX: (937) 275-9566
EMAIL: bar@barsplice.com

BPI-Grip™ Systems

FIELD APPLIED TENSION/COMPRESSION MECHANICAL SPLICES

CONTENTS

1.0 EQUIPMENT DESCRIPTION

1.1 The splicing equipment consists of a hydraulically operated field press fitted with a two-piece die set. A high-pressure hydraulic hose connects the press to a high-pressure pump. The pump is driven by an electric motor.

1.2 A foot pedal controls the system. When the foot pedal is depressed, hydraulic fluid is pumped along the hose to the press. The ram of the press extends so as to push one die towards the other. The dies swage (squeeze) the coupler onto the rebar. The coupler deforms around the profile of the rebar so that it interlocks with the rebar.

1.3 Releasing the foot pedal causes the ram to retract and the dies to separate so that the rebar and coupler can be repositioned for the next "bite".

1.4 The Field Swaging systems consist of the following:

1.4.1 Field Press - for cold swaging BPI couplers. Featuring: a single-acting hydraulic cylinder and provision for lifting horizontally and vertically.

1.4.2 Two-piece die sets are color coded.

1.4.3 Hydraulic pump unit can be supplied in one of two sizes depending on electrical requirements at the jobsite.

1.4.3.1 PE400 Pump - 10 HP electric motor, wired 230 volts or 460 volts (as required) 3 phase, 30 amp or 15 amp current draw; 3 position 4 way solenoid valve control, operated by a foot control. Pressure switch automatically cuts off the pressure at 10,000 psi minimum, (10,600 psi maximum). Certified hydraulic pressure gauge is fitted to the pump. **Figure 1A** shows the complete system.

1.4.3.2 PE55 Pump - 1 ⅛ HP electric motor, wired 115 volts (or other voltage as required) 1 phase, 30 amp current draw, automatic valve control, operated by a foot control. Pressure switch automatically cuts off the pressure at 10,000 psi minimum, (10,600 psi maximum). A certified hydraulic pressure gauge is fitted to the pump. **Figure 1B** shows the complete system.

1.4.4 High-pressure hose - 10,000 psi working pressure, specially braided for flexibility and strength. Do not use any hose except that provided by Barsplice Products, Inc. (BPI).

FIGURE 1A:
FIELD SWAGING SYSTEM WITH PE400 PUMP

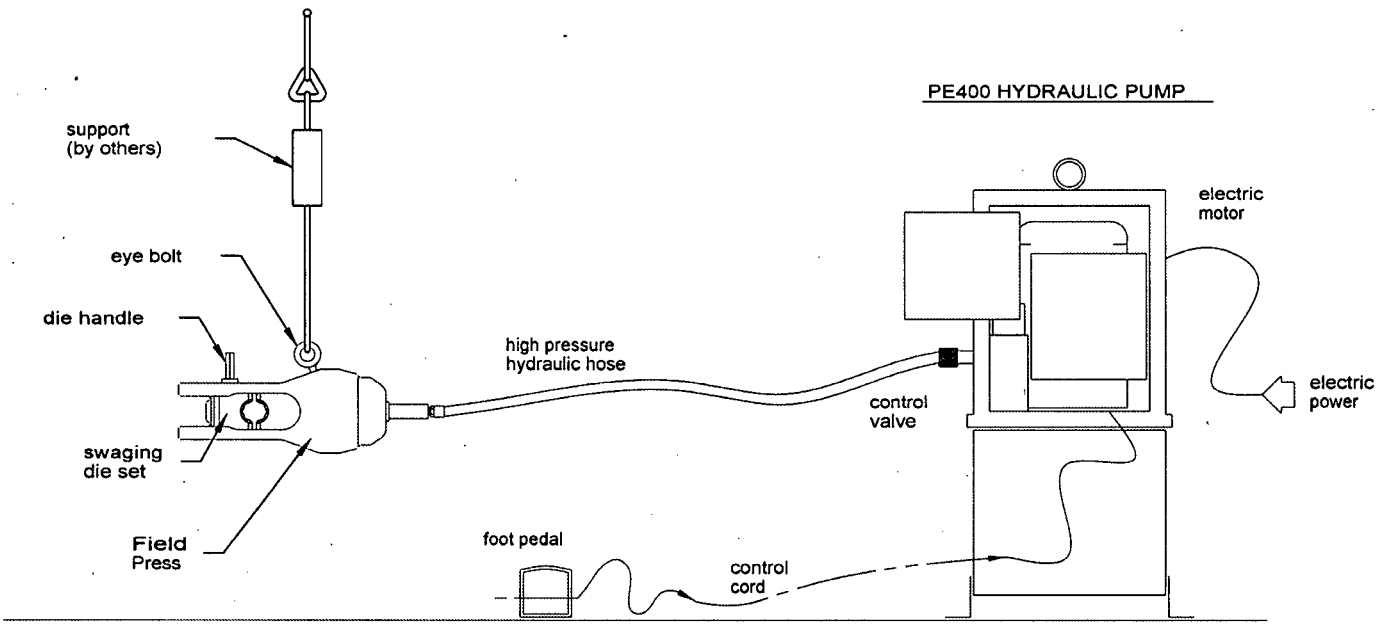
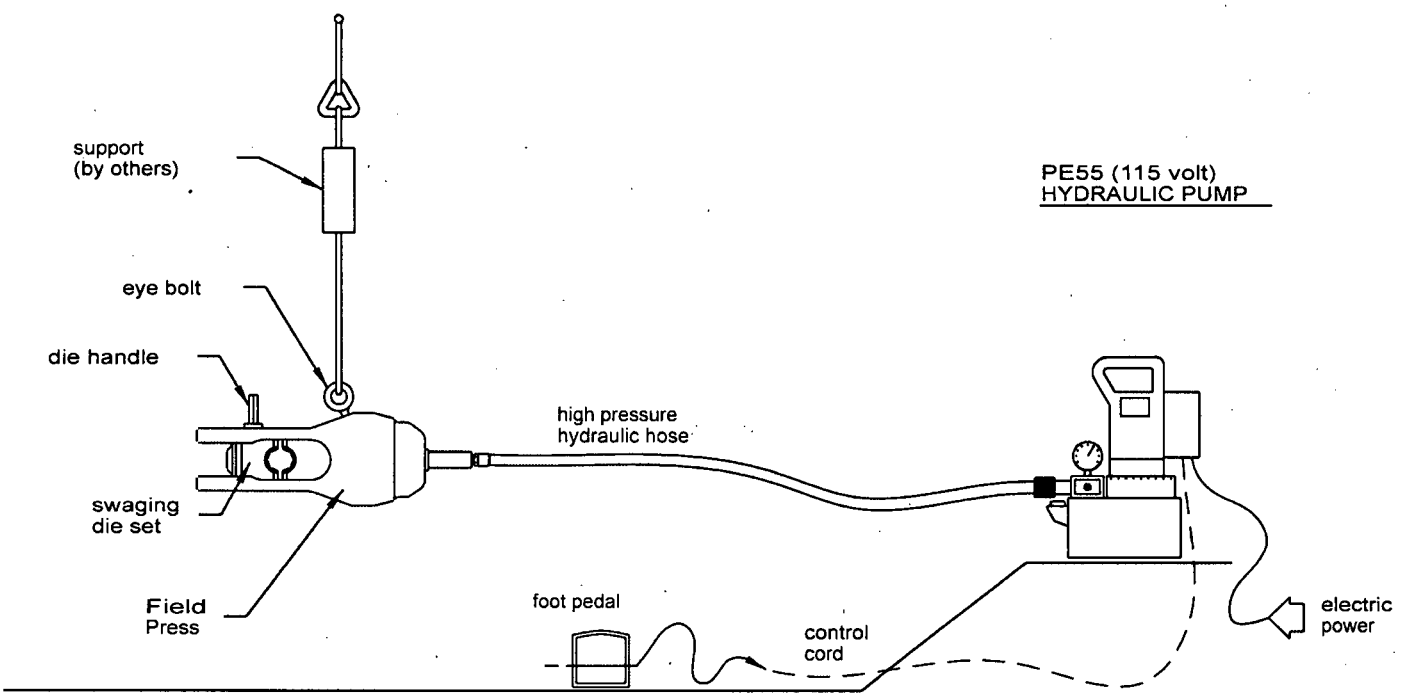


FIGURE 1B:
FIELD SWAGING SYSTEM WITH PE55 PUMP



2.0 PREPARATION

2.1 Make sure you have everything shown on packing slips and/or equipment records. Identify and record model numbers and date(s) received in case you need to discuss the system with BPI.

2.2 Check the equipment for damage which might have occurred in transit i.e., broken wires, bent or loose fittings, leaking fluid, cracked/broken glass on the pressure gauge. Check the press for bent, broken, cracked or distorted parts. Call BPI if you suspect anything is wrong or if anything seems to be missing.

2.3 DO NOT USE MISUSED OR DAMAGED EQUIPMENT. PERSONAL INJURY MAY OCCUR.

2.4 If after reading the instructions in this manual you are not sure about the system, call BPI. By arrangement, a technician can come to your job-site to train and certify personnel in the safe and correct operation of splicing equipment.

2.4.1 Choose a method of supporting the Field press, i.e. suspend from scaffolding or suitable support using a chain-fall, come-along, etc. Eyebolts are provided on the press and these eyebolts may be fitted in alternative positions to suit horizontal, diagonal and vertical applications. If the Field press is to be used as a "Bench Press", it may be placed on a bench and secured to the bench using suitable clamps, bolts or lag screws. **Figure 2** shows the nominal press dimensions.

2.4.2 Position the pump at the work area so that the hose can be connected between the pump and press without kinking or twisting. Before first use, check the pump over for any damage which might have occurred during transit; i.e. broken wires, loose fittings, leaking fluid. Inspect the pressure gauge on the pump and make sure the face is not cracked or broken.

2.4.3 Check the hydraulic fluid level at the pump filler cap. If the fluid level is low, clean the area from around the filler cap, remove the cap and fill to the screen within the tank. Do not overfill or add fluid when the equipment is running. The pump is shown in **Figure 3**.

2.4.4 Hydraulic Fluids

Some interchangeable hydraulic fluids are:

MANUFACTURER	TRADE NAME
Amoco Oil Co.	Rykon #46 or Amoco AW46
Conoco Inc.	Super Hydraulic Oil 46
Exxon Co.	Nuto 46
Phillips Petroleum	Magnus A Oil 46
Pennzoil Co.	AW Hydraulic Oil 46
Shell Oil	Telius 46
Standard Oil	HLP 46
Boron Oil	Industron 48
Texaco	Rando Oil HD 46
Union Oil Co.	Unax AW46

The fluid is classified as ISO viscosity grade 46, high-pressured anti-wear hydraulic fluid. (Viscosity at 100 degrees Fahrenheit = 194-236 SUS).

DO NOT USE ANY TYPE OF HYDRAULIC FLUID NOT RECOMMENDED BY BPI.

FIGURE 2:
FIELD PRESSES (DIMENSIONS IN INCHES)

SIDE VIEW	TOP VIEW
BG250 PRESS	
BG400 PRESS	
BG750M PRESS	
BG1140M PRESS	

3.0 THE ELECTRICAL SUPPLY

3.1 Have a qualified person check the power source, cords, plugs, receptacles and switches for conformance to all national and local standards.

3.2 DO NOT CONNECT OR USE THE EQUIPMENT UNTIL A SAFETY CHECK HAS BEEN COMPLETED.

3.3 The PE400 pump has been pre-wired for 230 volts or 460 volts (as required), 3 phase, 60 Hz. DO NOT ATTEMPT TO USE THE EQUIPMENT AT THE WRONG VOLTAGE. REQUIRED VOLTAGE MUST BE AT PUMP. CHECK ALL PHASES WITH VOLTMETER. DO NOT USE IF THERE IS A PHASE IMBALANCE.

3.4 The PE55 pump has been pre-wired for 115 volts or 230 volts (as required), single phase, 60 Hz. DO NOT ATTEMPT TO USE THE EQUIPMENT AT THE WRONG VOLTAGE. REQUIRED VOLTAGE MUST BE AT PUMP.

3.5 DO NOT USE EXCESSIVELY LONG POWER CORDS WHICH CAUSE POWER LOSS AND VOLTAGE DROP AT THE PUMP. Use heavy duty 8-gauge wire. Always make sure that the power supply and pump are properly grounded (earthed).

3.6 Make sure that the voltage at the pump motor is correct when the pump is running at maximum pressure.

3.7 DO NOT OPERATE THE EQUIPMENT UNDER LOW VOLTAGE. Incorrect power supply will cause the motor to overheat and cut-out.

See GENERAL SAFEGUARDS AND PRECAUTIONS, SECTION 13.0.

4.0 CONNECTING PRESS TO PUMP

4.1 The pump supplied with the Field press can only be used with a Field press.

4.2 The Field press is a "single acting, spring return" press which requires the connection of a single hose from the high-pressure side of the pump.

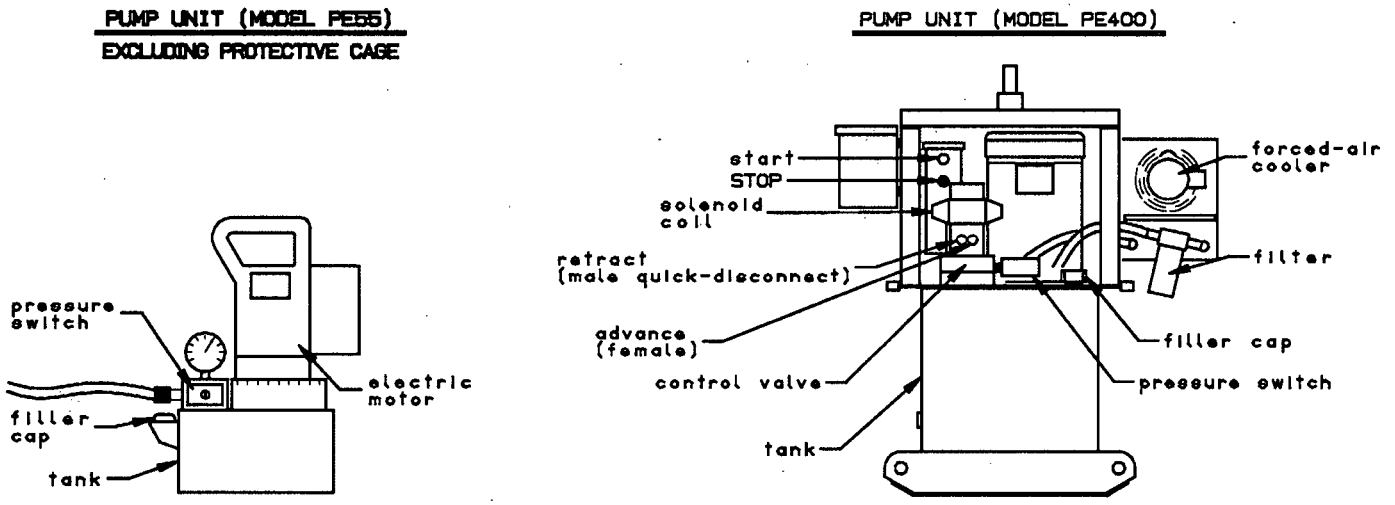
4.3 The pump unit is shown in **Figure 3**.

4.4 Connect the pump to the Field press using one (1) BPI high-pressure hydraulic hose. Hose connectors or quick-disconnect fittings must be wiped clean of dust, grit and water or other contamination before assembling. Make sure that the fittings are fully seated and tightened during assembly. No threads should be visible after proper assembly.

4.5 CAUTION: THE SYSTEM PRESSURE IS VERY HIGH. USE ONLY HOSE SUPPLIED BY BPI.

4.6 Never try to operate the equipment unless the hose is properly connected. Damage to the equipment will occur.

FIGURE 3:
PUMP UNITS



5.0 DIE INSTALLATION

5.1 There are two halves to each die set. One half is attached to the moving ram of the press. The other half (outer die) is held in a "leg yoke" by means of a removable outer die pin. Figure 4 shows the die set installation.

5.2 **To Remove the Dies**

5.2.1 Retract the ram, switch off the pump.

5.2.2 Remove the outer die first by taking out the outer die pin and then sliding the die block from the leg yoke (ref. **Figure 4**).

5.2.3 Remove the inner die by loosening two (2) inner die screws and by pulling the die forward and off the locating pins on the ram of the machine.

5.3 **To Install the Dies**

5.3.1 Make sure you have the correct die set by the rebar size which is stamped on the die set and the die color code which must match the coupler color code. Keep die sets together as pairs; make sure the same serial number is stamped on each half. Clean up the sliding surfaces.

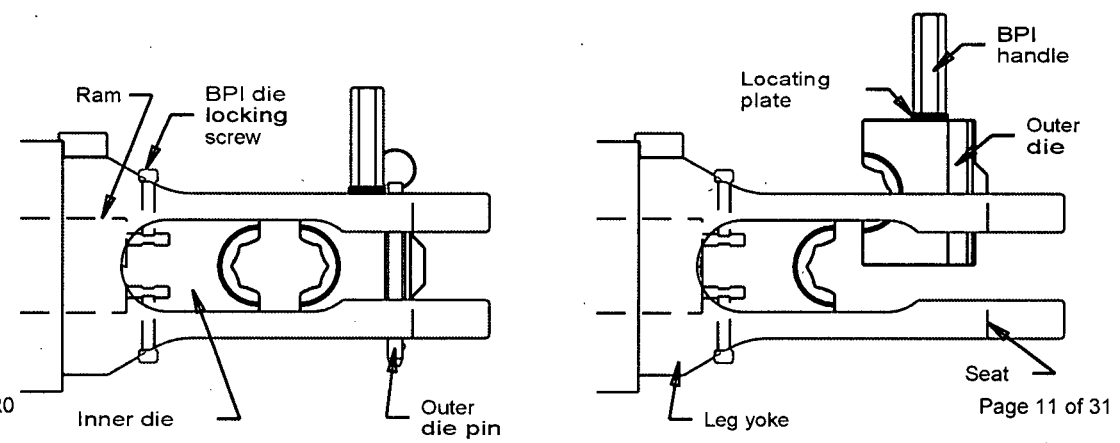
5.3.2 Refer to **Figure 4**. The inner die must be fitted into the press first. Slide the inner die into the leg yoke of the press and locate it onto the ram. Fix in place using two BPI die locking screws. Note: **Use only BPI locking screws, no other type of screw will fit.**

5.3.3 The outer die is the removable die. Fit a BPI handle to one side of the die along with the locating plate. Slide the die into the leg yoke so that it locates on the seats as shown in **Figure 4**.

5.3.4 Push the BPI outer die locating pin into position. **You must insert this pin every time you make a splice**. Failure to comply will result in extensive damage to the press.

5.3.5 **WARNING**: In use, the ram of the press pushes the inner die towards the outer die under great force to deform steel couplers onto rebar. Pinch points exist at the point of operation on dies. IT IS CRITICAL THAT A PERSON NEVER PLACE ANY PORTION OF ONE'S BODY IN THE AREA BETWEEN THE DIES WHEN THE OUTER DIE IS IN PLACE, AND THE HYDRAULIC SYSTEM IS HOOKED-UP WITH THE ELECTRICAL SOURCE CONNECTED.

FIGURE 4: DIE SET INSTALLATION



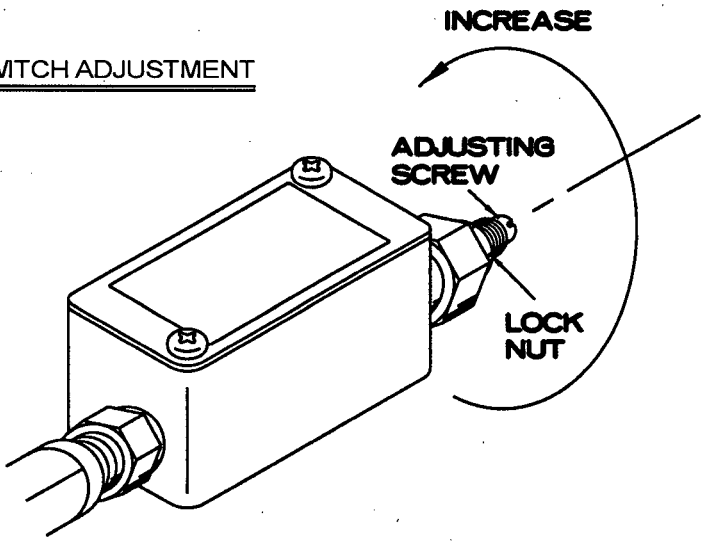
6.0 OPERATION AND CARE OF EQUIPMENT

6.1 Switch the pump "ON" at the pump (if PE400, 3-phase). Note: The PE55 pump is designed to run only when the foot pedal attached to the pump unit is depressed.

6.2 With the hydraulic press properly connected to the pump unit, check that the ram extends and retracts by alternately depressing and releasing the foot pedal. Remove your foot from the foot pedal if a problem develops (example: leak).

6.3 Check that the pressure reaches 10,000 psi minimum (10,600 psi maximum) when making a "bite". If the pressure switch cuts-out too low, make the necessary adjustment to the pressure switch by loosening the locknut and turning the slotted screw inwards a little at a time. Do not tamper with hydraulic valves. (Ref. **Figure 5**). Re-tighten the locknut at the correct pressure.

FIGURE 5: PRESSURE SWITCH ADJUSTMENT



6.4 The pressure gauge on the hydraulic pump should be checked for accuracy at least every 200 connections and/or whenever damage may have occurred.

6.5 To check the pump pressure gauge, connect an in-line calibrated and certified 'TEST' pressure gauge.

6.6 See that nothing obstructs airflow around the pump unit. Keep the unit clean for maximum cooling.

6.7 Each day, check the hydraulic fluid level, check the hydraulic hose for cuts and leaks and check the electrical power cord for cuts and damages.

6.8 At all times, make sure dirt and water do not enter the hydraulic system.

6.9 If you disconnect the hose, always make sure there is no pressure in the system. Replace dust caps afterwards.

6.10 Cleanliness is the key to minimum breakdowns of the equipment. Any type of sand, dirt, grit, or foreign objects that get into the pump or press can cause irreversible damage. When not in use, store the equipment in a dry location where the possibility of damage is minimized.

6.11 See GENERAL SAFEGUARDS AND PRECAUTIONS, Section 13.0.

7.0 REBAR PREPARATION, INSPECTION, PRECAUTIONS

7.1 Bar ends must be straight. Be sure shear blades are not dull. Be sure shear machine is correctly set-up and blades are in proper alignment. **DO NOT USE BARS WITH BENT OR CURVED ENDS**.

7.2 On flame cut rebar ends and shear cut ends, remove any excessive slag or shear lips which prevent proper insertion of the rebar into the coupler or cause misalignment.
CAUTION: **DO NOT OVER-GRIND OR EXCESSIVELY ROUND-OFF REBAR ENDS**.

7.3 Saw-cut ends normally do not require further preparation. When straightness of coupler to rebar is critical during assembly of the bars in the field or if there are problems with the shear method or shear line equipment, then saw cutting of the rebar ends is recommended.

7.4 Ensure rebar ends are cleaned of heavy dirt, grease, concrete or loose matter as would be done on rebar prior to a concrete pour.

7.5 If deformations have been omitted to accommodate mill marks, that portion of rebar should not be inserted into the coupler unless pre-qualified by tests which simulate the condition.

7.6 If the rebar longitudinal ribs are excessively high and prevent the proper insertion of the rebar into the coupler, they should be removed by grinding. A "bar-end check" ahead of time using a BPI-Grip coupler as a gage can preclude this condition.

7.7 It is not permissible to crush excessively high longitudinal ribs and circular deformations.

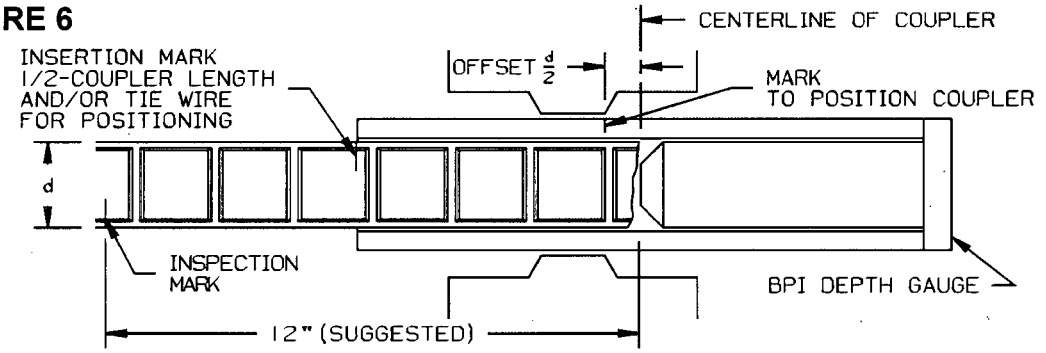
8.0 SWAGING PROCEDURE FOR BPI-GRIP COUPLERS

8.1 Make sure the correct dies have been installed in the press by referring to the stamping and/or to the color codes shown in the table following **Figure 6**. The color code of the coupler must match the color code of the die set.

8.2 Insert the rebar one-half the coupler length by using a BPI depth gauge or twist on a piece of tie-wire at the insertion mark if it helps (see **Figure 6**). The rebar should slide in easily; if it does not, check for excessive shear lip, excessive shear drag or high longitudinal ribs. DO NOT TRY TO FORCE REBAR INTO THE COUPLER. DO NOT USE BARS WITH BENT OR CURVED ENDS.

8.3 Insert the coupler and rebar between the dies. Adjust the position of the coupler so that the bite area of the dies is over the rebar and offset from the center as shown in **Figure 6**. **DO NOT ATTEMPT TO SWAGE ANY PART OF THE COUPLER WITHOUT REBAR INSERTION**.

FIGURE 6



REBAR SIZE (US)	REBAR SIZE (US metric)	BPI-Grip (**BarGrip**) COUPLER LENGTH (inch)	BPI-Grip (**BarGrip**) REBAR INSERTION (inch)	BPI-Grip (**BarGrip XL**) COUPLER LENGTH (inch)	BPI-Grip (**BarGrip XL**) REBAR INSERTION (inch)	BPI-Grip (**BarGrip UXL**) COUPLER LENGTH (inch)	BPI-Grip (**BarGrip UXL**) REBAR INSERTION (inch)	COUPLER & DIE COLOR CODE
No. 3	10	2	1	3 1/4	1 5/8	4 1/2	1 1/4	ORANGE
No. 4	13	2 1/2	1 1/4	4	2	5 1/4	2 5/8	PINK
No. 5	16	3 1/8	1 9/16	4 3/4	2 3/8	6	3	RED
No. 6	19	3 3/4	1 7/8	5 1/2	2 3/4	6 3/4	3 3/8	YELLOW
No. 7	22	4 3/8	2 3/16	6 1/4	3 1/8	7 1/2	3 3/4	BLUE
No. 8	25	5	2 1/2	7	3 1/2	8 1/2	4 1/4	BLACK
No. 9	29	5 1/2	2 3/4	7 1/2	3 3/4	9 1/4	4 5/8	RED
No. 10	32	6 5/16	3 1/8	8 1/4	4 1/8	10	5	YELLOW
No. 11	36	6 7/8	3 7/16	9	4 1/2	10 3/4	5 3/8	BLUE
No. 14	43	8 3/4	4 3/8	11	5 1/2	13	6 1/2	PINK
No. 18	57	12	6	14	7	16	8	RED

8.4 After the coupler is in place and the rebar has been properly inserted, depress the foot pedal to close the dies and allow the pressure to rise to 10,000 psi minimum (10,600 psi maximum) at which time the pressure will automatically shut off. Release the foot pedal to retract the dies. If you make a mistake or there is a problem, always remove your foot from the foot pedal.

8.5 If two bites are required to half-swage a BPI-Grip coupler to the first reinforcing bar, the second bite should overhang the edge of the coupler at the point of entry of the rebar by ⅛ inch as shown in **Figure 7A**. If more than two bites are required, the second and additional bites should overlap the previous bite by ⅛ – ¼ inch as shown in **Figure 7B**. Keep in mind that the end bite should always overhang the edge of the coupler by ⅛ inch.

FIGURE 7A

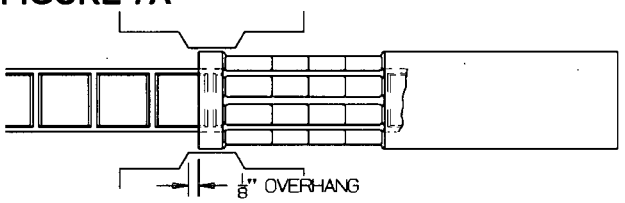
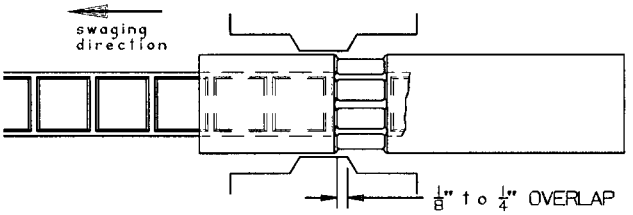
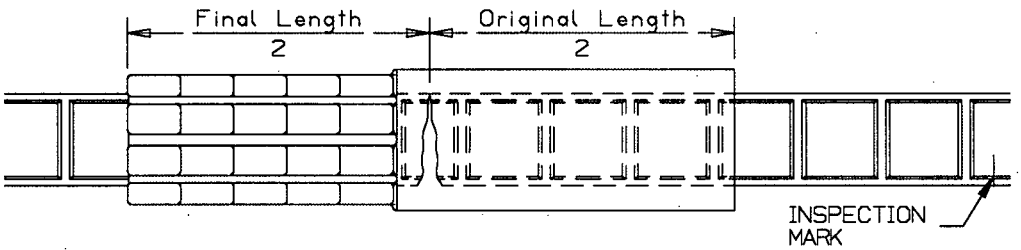


FIGURE 7B



8.6 Once the coupler is repositioned for the second bite, depress the foot pedal to close the dies. Allow the pump pressure to reach 10,000 psi and automatically shut off. Release the foot pedal to retract the dies. When correctly installed, half-swaged BPI-Grip couplers will be as shown in **Figure 8**.

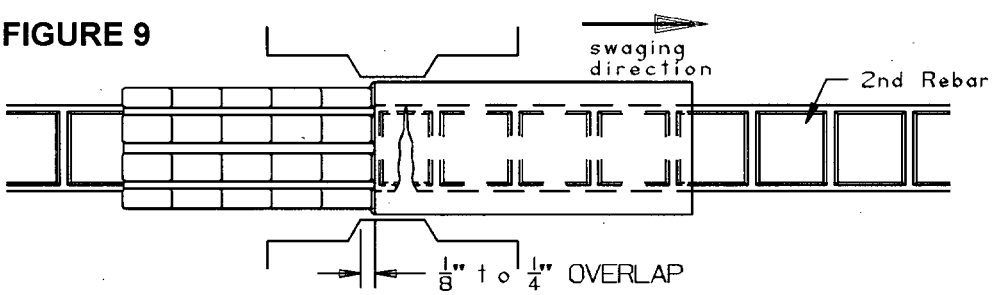
FIGURE 8



8.7 Make an inspection mark 12" from the end of the rebar as shown in **Figure 8** and insert the second rebar so as to abut against the first bar.

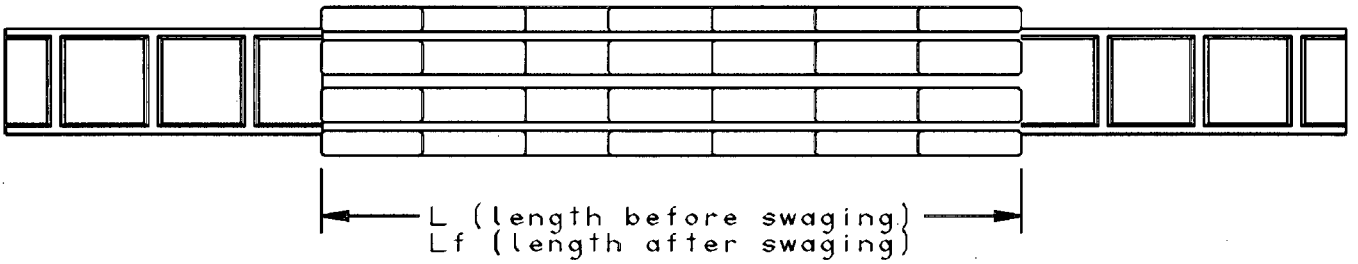
8.8 Continue to make overlapping bites starting at the middle and successively overlapping in an outward direction of travel so that the entire coupler is swaged **(see Figure 9)**. Refer to the table following **Figure 10** for the minimum number of bites to fully swage a BPI-Grip coupler to rebar. As before, bites should overlap ⅛" to ¼" unless the bite overhangs the end of the coupler in which case the overhang should be ⅛".

FIGURE 9



8.9 A fully swaged BPI-Grip coupler will appear as shown in Figure 10. NOTE: There should be no parts of the coupler that remain unswaged.

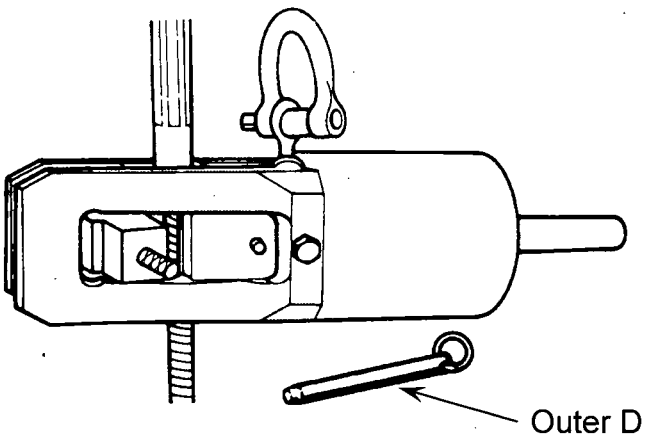
FIGURE 10



REBAR SIZE US	BPI-Grip (**BarGrip**)					BPI-Grip (**BarGrip XL**)					BPI-Grip (**BarGrip UXL**)				
	MINIMUM NUMBER OF BITES				AVERAGE FINAL LENGTH AFTER SWAGING	MINIMUM NUMBER OF BITES				AVERAGE FINAL LENGTH AFTER SWAGING	MINIMUM NUMBER OF BITES				AVERAGE FINAL LENGTH AFTER SWAGING
	BG250 Press	**BG400 Press**	**BG750 Press**	**BG1140M Press**		**BG250 Press**	**BG400 Press**	**BG750 Press**	**BG1140M Press**		**BG250 Press**	**BG400 Press**	**BG750 Press**	**BG1140M Press**	
No. 3	3	3	2		2 1/8	5	3	3		3 1/2	7	5	N/A		4 7/8
No. 4	4	3	3	N/A	2 5/8	7	5	4	N/A	4 5/16	9	7	6		5 3/4
No. 5	6	4	3		3 3/8	9	6	4		5 1/8	13	7	5	N/A	6 5/8
No. 6	9	5	3	3	4	14	9	4	4	6 1/16	22	10	5		7 7/16
No. 7		7	4	3	4 5/8		11	5	4	6 15/16		13	6		8 3/16
No. 8		9	5	3	5 3/8		14	6	5	7 3/4		18	7	6	9 1/4
No. 9			7	5	6			8	6	8 1/4			11	8	10 1/8
No. 10	N/A		9	6	6 3/4	N/A		11	8	9 1/8	N/A		14	10	11
No. 11		N/A	12	7	7 3/8		N/A	14	9	10		N/A	16	11	11 3/4
No. 14			N/A	11	9 3/8			N/A	14	12 1/4			N/A	16	14 3/8
No. 18				21	12 3/4				25	15 1/2				28	17 3/4

8.10 To remove the press from around the splice, move it clear of the splice, pull out the outer-die pin and remove the outer-die **(See Figure 11).** Always make sure the outer-die pin is refitted when making the next splice. **Disconnect power to the pump when not in use.**

FIGURE 11



9.0 SWAGING PROCEDURE FOR BPI-GRIP TRANSITION COUPLERS

9.1 Make sure the correct dies have been installed in the press by referring to the stamping and/or to the color codes shown in the table following **Figure 12**. The color code of the coupler must match the color code of the die set.

9.2 Measure and mark the outside of the transition coupler for the swage length "S" of the larger bar side as shown in the table following **Figure 12**. Mark the side of the transition coupler that has the larger inside diameter.

9.3 Make an inspection mark 12" from the end of the rebar and insert the LARGER rebar to the correct rebar insertion length " i " or twist on a piece of tie-wire at the insertion mark if it helps (see **Figures 12A** and **12B**). The rebar should slide in easily; if it does not, check for excessive shear lip, excessive shear drag or high longitudinal ribs. DO NOT TRY TO FORCE REBAR INTO THE COUPLER. DO NOT USE BARS WITH BENT OR CURVED ENDS. DO NOT USE A TRANSITION COUPLER OTHER THAN WITH THE INTENDED BAR SIZES.

9.4 Insert the transition coupler and rebar between the dies. Adjust the position of the coupler so that the bite area of the dies is over the rebar and lined up with the mark on the outside of the coupler as shown in **Figures 12A** and **12B**. **DO NOT ATTEMPT TO SWAGE ANY PART OF THE COUPLER WITHOUT REBAR INSERTION**.

FIGURE 12A:
(BarGrip Transition)

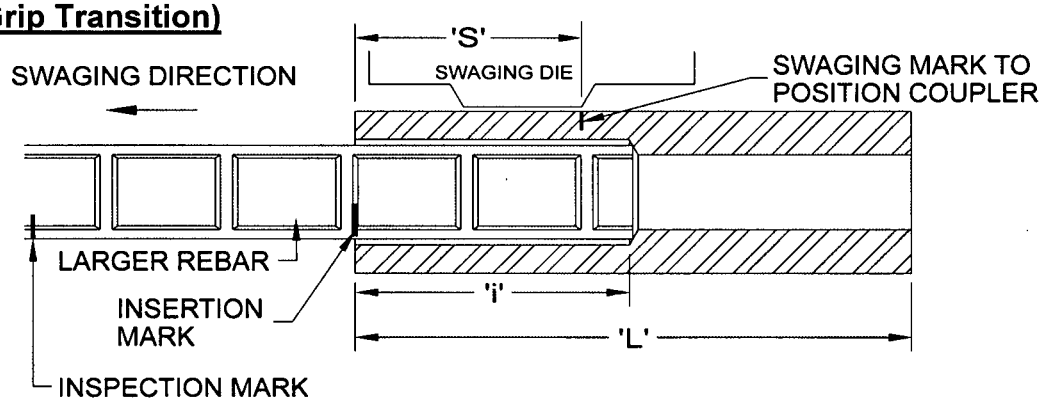
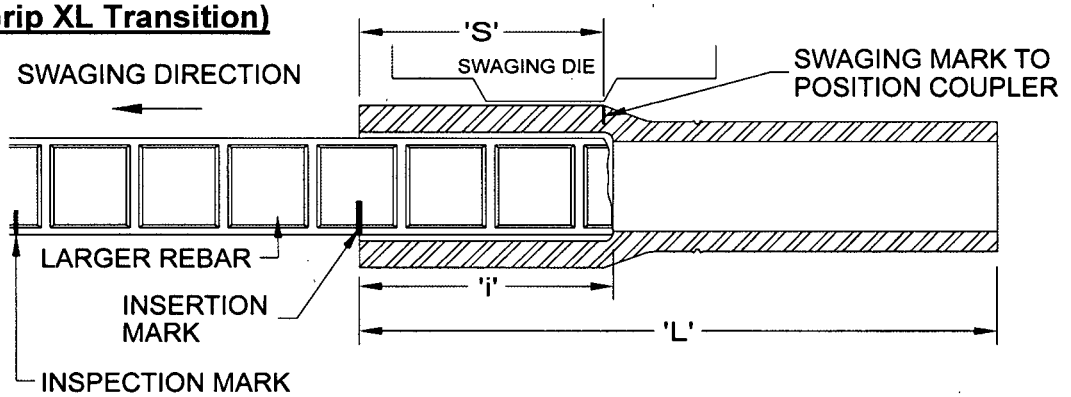


FIGURE 12B:
(BarGrip XL Transition)



TRANSITION COUPLER SIZE	BPI-Grip (**BarGrip Transition**)				BPI-Grip (**BarGrip XL Transition**)			
	DIE SET COLOR CODE	COUPLER LENGTH " L " (inch)	REBAR INSERTION (larger bar) " i " (inch)	SWAGE LENGTH (larger bar) " S " (inch)	DIE SET COLOR CODE (larger bar / smaller bar)	COUPLER LENGTH " L " (inch)	REBAR INSERTION (larger bar) " i " (inch)	SWAGE LENGTH (larger bar) " S " (inch)
No. 5/4					Red / Pink	4 1/4	1 11/16	1 5/8
No. 6/5					Yellow / Red	5 1/4	2 1/16	2
No. 7/6					Blue / Yellow	5 7/8	2 7/16	2 3/8
No. 8/7					Black / Blue	6 1/2	2 7/8	2 3/4
No. 9/8					Red / Black	6 1/8	2 7/8	2 3/4
No. 10/8					Yellow / Black	6 7/8	2 15/16	2 7/8
No. 10/9	Orange	6	3	2 1/2	Yellow / Red	6 7/8	3 1/16	3
No. 11/9	Orange	6 1/2	3 1/2	3	Blue / Red	8 1/2	3 1/2	3 3/8
No. 11/10	Blue	7	3 1/2	3	Blue / Yellow	8 1/2	3 1/2	3 3/8
No. 14/11	Brown	7 3/8	3 3/4	3 1/8	Pink / Blue	10 1/8	3 7/8	3 3/4
No. 18/14					Red / Pink	11 9/16	4 1/2	4 3/8

9.5 After the transition coupler is in place and the rebar has been properly inserted, depress the foot pedal to close the dies and allow the pressure to rise to 10,000 psi minimum (10,600 psi maximum) at which time the pressure will automatically shut off. Release the foot pedal to retract the dies. If you make a mistake or there is a problem, always remove your foot from the foot pedal.

9.6 If two bites are required to swage the larger bar side of a BPI-Grip transition coupler to the reinforcing bar, the second bite should overhang the edge of the coupler at the point of entry of the rebar by ⅛ inch as shown in **Figure 13A**. If more than two bites are required, the second and additional bites should overlap the previous bite by ⅛ – ¼ inch as shown in **Figure 13B**. Keep in mind that the end bite should always overhang the edge of the coupler by ⅛ inch.

FIGURE 13A

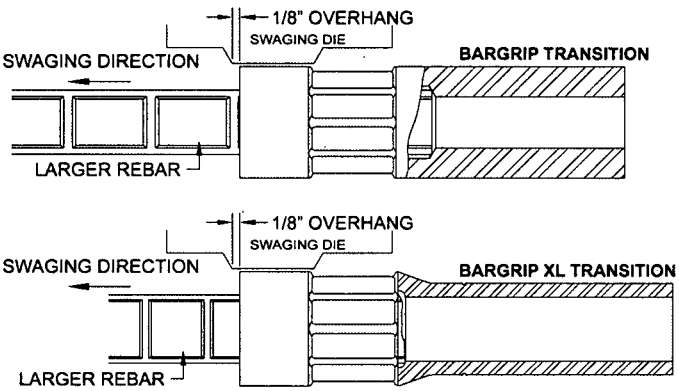
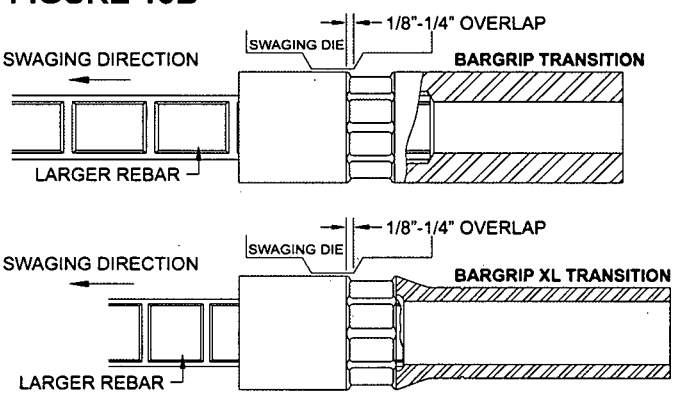


FIGURE 13B

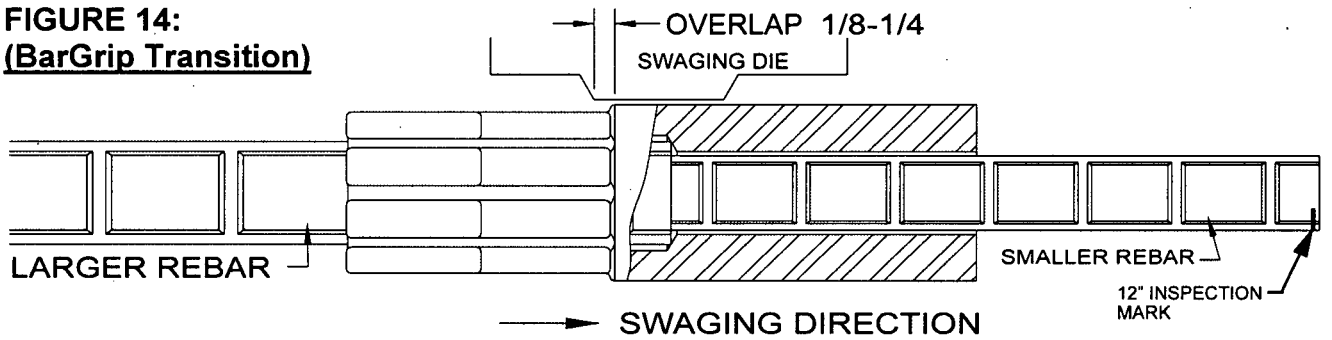


9.7 Once the coupler is repositioned for the second bite, depress the foot pedal to close the dies. Allow the pump pressure to reach 10,000 psi and automatically shut off. Release the foot pedal to retract the dies. When correctly installed, the larger bar side of BPI-Grip transition couplers will be as shown in **Figures 14 and 15**.

9.8 Make an inspection mark 12" from the end of the smaller rebar and insert the second rebar so as to abut against the first bar.

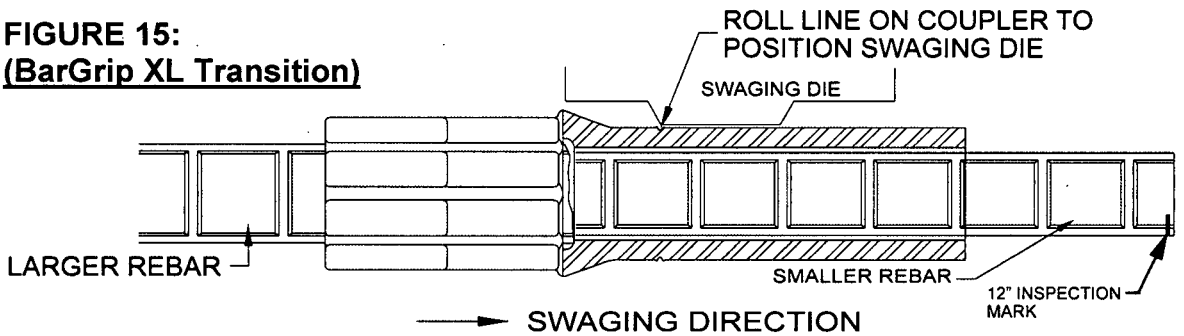
9.9 For BarGrip Transition couplers, continue to make overlapping bites starting at the middle and successively overlapping ⅛" – ¼" in an outward direction of travel so that the entire coupler is swaged **(see Figure 14)**. When finished with the swaging, the completed splice should appear as shown in **Figure 16A**.

FIGURE 14:
(BarGrip Transition)



9.10 For BarGrip XL Transition couplers, line up the swaging die with the roll line on the outside of the coupler **(see Figure 15)**. Continue to make successively overlapping bites starting from the roll line and overlapping ⅛" – ¼" in an outward direction of travel. When finished with the swaging, the completed splice should appear as shown in **Figure 16B**.

FIGURE 15:
(BarGrip XL Transition)



9.11 Refer to the table following **Figure 16** for the minimum number of bites to fully swage a BPI-Grip transition coupler to rebar. As before, bites should overlap ⅛" to ¼" unless the bite overhangs the end of the coupler in which case the overhang should be ⅛".

FIGURE 16A:
COMPLETED SPLICE (BarGrip Transition)

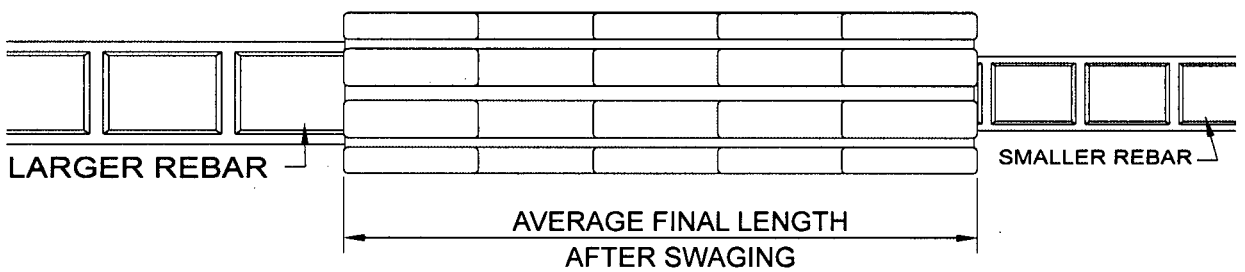
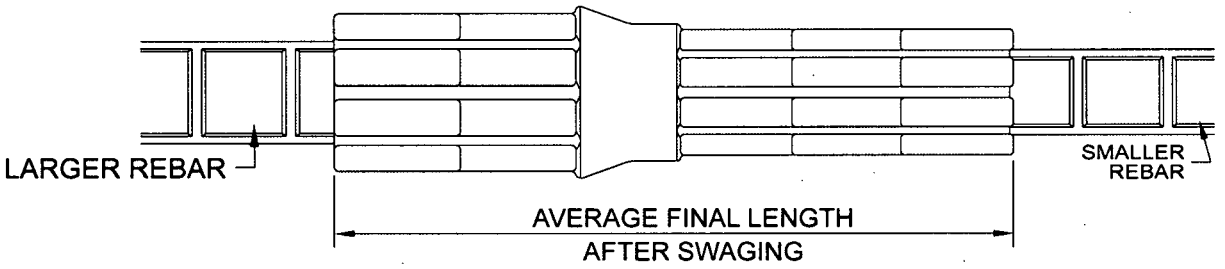


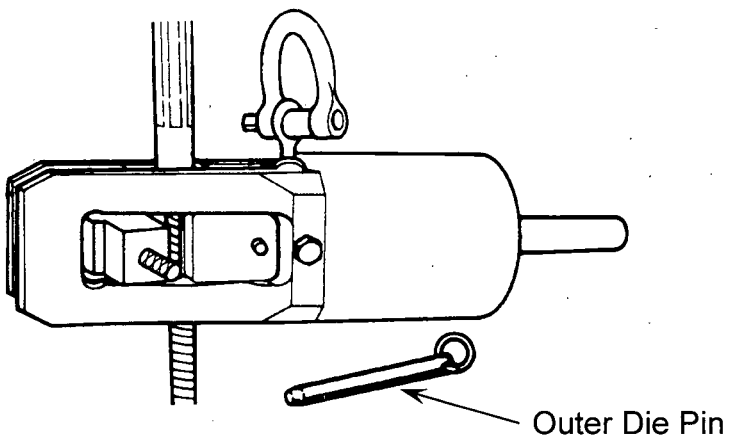
FIGURE 16B:
COMPLETED SPLICE (BarGrip XL Transition)



REBAR SIZE US	BPI-Grip (**BarGrip Transition**)					BPI-Grip (**BarGrip XL Transition**)								
	MINIMUM NUMBER OF BITES				AVERAGE FINAL LENGTH AFTER SWAGING	MINIMUM NUMBER OF BITES								AVERAGE FINAL LENGTH AFTER SWAGING
	BG250 Press	**BG400 Press**	**BG750 Press**	**BG1140M Press**		**BG250 Press**		**BG400 Press**		**BG750 Press**		**BG1140M Press**		
						(larger bar)	(smaller bar)	(larger bar)	(smaller bar)	(larger bar)	(smaller bar)	(larger bar)	(smaller bar)	
No. 5/4	6	4	3	N/A	3 1/4	3	3	2	2	2	2			4 1/2
No. 6/5	7	4	3		3 5/8	5	4	3	3	2	2	N/A		5 5/8
No. 7/6	9	5	3	3	4			4	4	2	2			6 3/8
No. 8/7		7	4	3	4 5/8			5	5	2	2			7 1/8
No. 9/8		9	5	3	5 3/8			6	6	3	3	2	2	6 9/16
No. 10/8			N/A							4	3	3	2	7 5/16
No. 10/9	N/A		7	5	6 1/2	N/A				4	4	3	3	7 3/8
No. 11/9		N/A	8	5	7			N/A		5	4	4	3	9 1/8
No. 11/10			12	7	7 1/2					5	5	4	4	9 1/8
No. 14/11			N/A	9	7 7/8					N/A		5	4	10 3/4
No. 18/14				16	9 3/8							7	6	12 1/2

9.12 To remove the press from around the splice, move it clear of the splice, pull out the outer-die pin and remove the outer-die **(See Figure 17).** Always make sure the outer-die pin is refitted when making the next splice. **Disconnect power to the pump when not in use.**

FIGURE 17



10.0 INSPECTION AND QUALITY CONTROL FOR BPI-GRIP COUPLERS

10.1 Check the alignment of the coupler to the main axis of the rebar. If the end of the rebar is curved due to the shear method or if there is a high shear lip, some adjustment of the shearing device may be necessary. When straightness of coupler to rebar is critical during swaging of the couplers in the field or if there are problems with the shear method or shear line equipment, then saw cutting of the rebar ends is recommended.

10.2 Routinely check the system pressure. Look at the pressure gauge on the pump. If damage to the pressure gauge occurs, have it checked or replaced. If splices are made at low pressure, re-swage them at the correct pressure.

10.3 Always make sure the correct dies have been fitted. Refer to the stamping and to the color codes. See the Table following **Figures 6** and **12**. Also check dies for wear using profile gauges. Apply liquid soap to each coupler to prevent sticking and binding and to reduce die wear.

10.4 Check that the coupler is swaged over the correct length. Swaged couplers should have an approximate overall length as shown in the Table following **Figures 10** and **16**.

10.5 Routinely check rebar insertion. Make an insertion mark on the rebar to check the distance from the end of the coupler to the bar end. Make sure rebars in couplers are not under-inserted.

11.0 SWAGING TIPS - RIGHTS AND WRONGS

11.1 Use rebars with straight ends. Dull shear blades cause bending and shear lips. **Figure 18**.

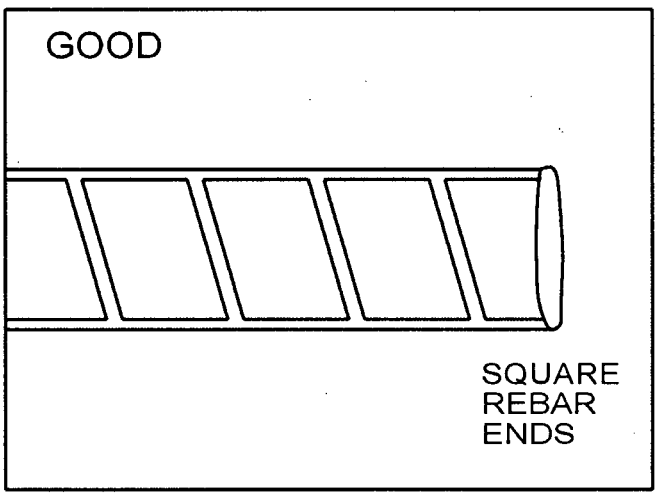
11.2 Keep the press square with the axis of rebar and couplers.

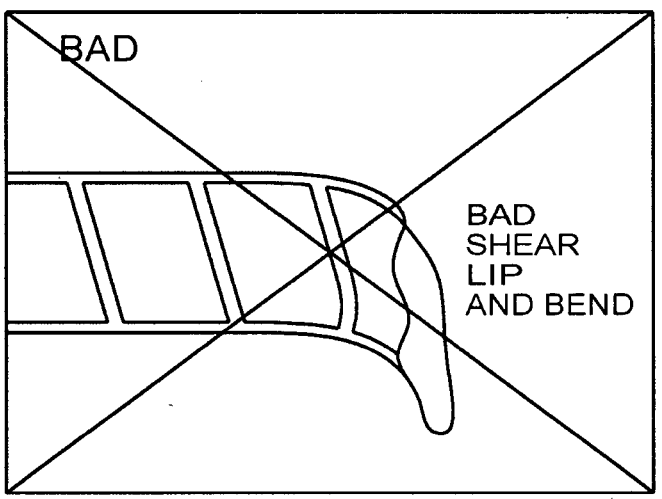
11.3 Keep the work area uncluttered.

11.4 Check that dies are properly fitted so that they come together properly aligned with each other.

11.5 Clean and lubricate both die profiles equally.

FIGURE 18





12.0 BPI SWAGING DIE QUALITY ASSURANCE PROGRAM

12.1 Dies must be cleaned periodically to prevent scoring and die wear. Operators should wipe dirt and grit off the swaging bite area at each start up and after the installation of every 20 (approx.) couplers. Always disconnect power to prevent accidental activation of the press during cleaning. Use a suitable penetrating/lubricating agent to get best results. A silicon based release agent such as "Krylon Mold Release" is appropriate. Most liquid soaps and cleaning gels give good results. In addition, if couplers are covered in dirt or grit, wipe their surfaces before swaging.

12.2 Die life will be enhanced by routine cleaning and may be decreased by taking insufficient care, particularly in areas where concrete dust is blowing around and sticking to the dies and/or couplers.

12.3 Keep die sets together by serial number. Do not mix dies of different serial number. Do not mix an old die with a new die. Do not swage anything other than the correct BPI coupler. Do not use the die to perform any other function than the use for which it is intended. Examples: Do not crush rebar, do not use die for flattening or bending, do not swage any brand of mechanical connection other than the correct one supplied by BPI.

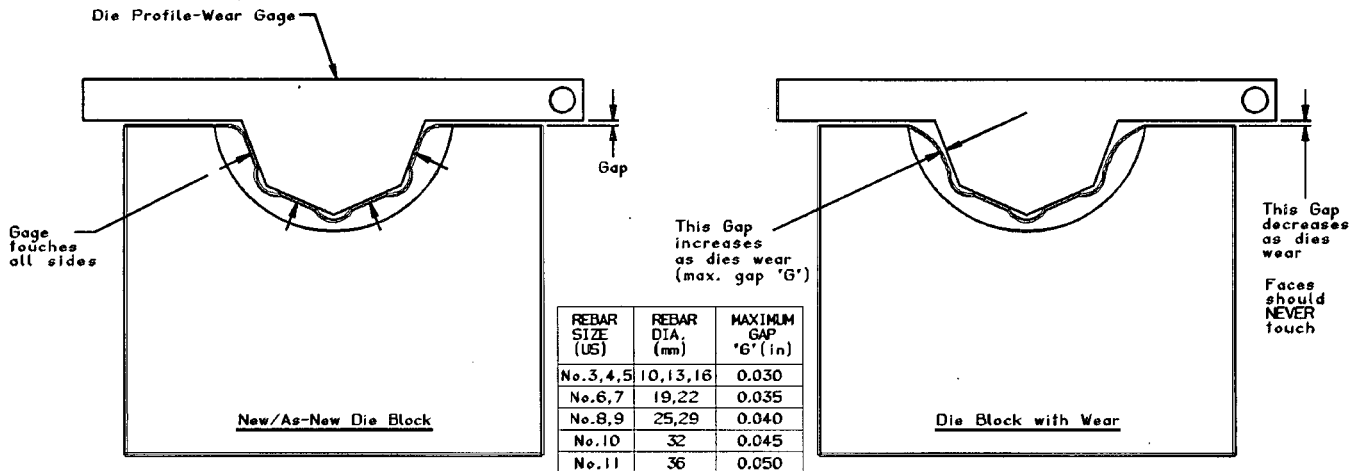
12.4 Confirming tension tests, if required in project specifications, should be made at the start of the job before production splicing. An on-going test program, if required in project specifications, will identify any anomalous behavior.

12.5 After every 1000 installed couplers, visually inspect dies for damage and/or wear. If relatively heavy scoring is observed on the bite area, check the die set with a profile gauge or contact BPI for a replacement set. Light scratches are normal and acceptable.

12.6 Where the number of couplers consigned to a project site exceeds the expected die life, then multiple die sets will be required.

12.7 The maximum gap between the profile gauge and the octagon die profile is shown in **Figure 19**.

FIGURE 19: DIE WEAR GAUGE



REBAR SIZE (US)	REBAR DIA. (mm)	MAXIMUM GAP 'G' (in)
No.3,4,5	10,13,16	0.030
No.6,7	19,22	0.035
No.8,9	25,29	0.040
No.10	32	0.045
No.11	36	0.050
No.14	43	0.060
No.18	57	0.075

13.0 GENERAL SAFEGUARDS AND PRECAUTIONS

13.1 In order to insure that equipment is operating in a safe and proper manner, read all instructions and warnings in this manual, especially the ones which follow. Should you have any questions concerning any instruction or precaution contained in this manual, please contact BarSplice Products, Inc at (937) 275-8700.

13.2 Wear protective clothing, hard hat and safety glasses. Keep work area well lit, clear, and uncluttered; know where your controls are and the red "stop" switch on the PE400 pump. (Note: The PE55 pump does not have an on/off switch. Pressing the foot petal activates the PE55 pump unit). Don't let unfamiliar personnel touch equipment; switch off and store in a safe place when not in use or unattended.

13.3 Do not force equipment, keep hands and body parts clear of dies when splicing; disconnect power when changing or cleaning dies.

13.4 Do not modify or attempt to defeat the function of controls; do not tamper with valves; always operate the system within its pressure limits; do not use equipment for any other purpose than that described in this manual. Do not apply pressure to kinked hoses; do not try to disconnect hoses while under pressure; do not force or over tighten hydraulic connections and never operate hydraulics without an accurate pressure gauge.

13.5 Disconnect electrical power when moving equipment; support and secure equipment using devices capable of withstanding weight; do not lift or pull hydraulic equipment by hoses or hydraulic connectors.

13.6 Check frequently for damaged parts; do not operate equipment which is cracked, bent, broken or misaligned; stop work immediately if a problem develops; disconnect power and report unsafe conditions or malfunctions.

13.7 Follow all national and local electrical and safety codes. Untrained persons must not attempt to make electrical repairs due to possibility of electrical shock. Unplug equipment when not in use; never touch bare wires when the equipment is connected to the power source; do not tamper with electrical connections; never by-pass the operation of any switch, components or electrical feature on the equipment; do not disconnect ground wires; be sure to cover or keep electrical equipment out of the rain and wet; do not use with D.C. (direct current) supply; circuits must be protected by fuse or circuit breaker.

13.8 Keep power cords and control cords out of the way of others; do not use damaged power cords; do not pull power cords over sharp edges or place sharp objects on them; keep power cords away from oil, chemicals, heat and heating devices; do not use electrical equipment in areas where flammable and/or explosive vapor or dust is present.

13.9 Do not allow foreign objects to enter any ventilation or exhaust openings as this may cause damage to fan blades and electric motors.

14.0 TROUBLESHOOTING PE400 PUMP UNIT

The following problems (P1, P2, P3, etc.) and solutions (A, B, C, etc.) are intended for the benefit of knowledgeable and suitably capable technicians and maintenance personnel. DO NOT PROCEED TO MAKE REPAIRS WITHOUT CHECKING WITH THE MANUFACTURER. Always disconnect electrical power when making repairs.

P1. PUMP MOTOR WILL NOT RUN AT ALL

A. No power reaching pump.
Check all three phases are being supplied to starter contacts. Check fuses or circuit breaker.

B. Broken start-switch assembly.
Check operation with continuity meter.

C. Previous overload.
Press reset button on bimetal overload relay inside control box.
(CARE! Electrical Hazard)

D. Starter coil transformer burned out.
Replace and locate short circuit before re-using.

E. Stuck stop-switch.
Check operation with continuity tester.

P2. PUMP MOTOR WILL RUN BUT SHUTS-OFF FREQUENTLY

A. Wrong voltage, causing overheating.
Check with voltmeter.

B. Wrong bimetal overload heater elements.
Check number stamped on the elements; compare with wiring diagram.

C. Long power cord.
Produces a voltage drop, shorten cord.

D. Bad connections, tears, breaks in power cord.
Inadequate power supply, replace power cord; check connections.

E. Phase imbalance, missing phase; pump sounds noisy.
Check with voltmeter.

F. Damaged pump.
Results in high amperage and heat.

G. Pressure switch loose.
Check adjustment. Tighten.

P3. PUMP MOTOR WILL RUN BUT NOTHING HAPPENS WHEN FOOT PEDAL IS DEPRESSED.

A. Control cord has broken/damaged wire or bad connection at foot pedal or control box.

B. Operation of foot pedal(s) impaired - check for mud, water, etc., check foot pedal micro switches for correct operation using continuity meter.

C. Contacts of DPDT relay defective or burned; replace the relay. Check the relay socket.

D. Pressure switch stuck or damaged; replace if necessary.

E. Solenoids for pilot section of hydraulic control valve burned-out; replace if necessary.

F. Broken hydraulic line inside the reservoir between the pump and the control valve; replace if necessary.

G. Broken shear pins between motor and pump drive shaft; replace if needed.

H. Hydraulic control valve jammed or operation impaired; check for broken springs and blown gaskets.

I. Catastrophic failure of pump or pump components caused by motor running backwards, contamination of the hydraulic fluid, water in the system or incorrect grade of hydraulic fluid; replace/repair as required.

J. No or low fluid level in tank - fill to bottom of filler screen. (If pump has had fluid change, it may be necessary to prime the pump.)

P4. PUMP RUNS BUT PERFORMANCE IS SLOW

A. Low voltage - check power source, voltage at the pump while under-load; power cord connections.

B. Hydraulic fluid contaminated with dirt, water or other substances; drain and clean tank; change the filter element; fill with new fluid.

C. Hydraulic fluid grade incorrect; use ISO viscosity Grade 46, high-pressure, anti-wear hydraulic fluid.

D. Strainer clogged - check and clean.

E. Hydraulic fluid too hot - check operation of forced-air oil cooler ; be sure the three vents are open; check that fluid is circulating to the cooler; check the operation of submersed circulating pump; check operation of thermostat; check power is being delivered from transformer (should be 115-120 volts). Keep pump unit shaded if necessary and off the ground for maximum cooling.

F. Hydraulic leak; check line inside the tank between pump and the control valve; check for any other external or internal leaks.

G. Broken seal and/or spring in control valve.

H. Fluid blowing across safety relief valve prematurely; adjust if necessary.

I. Unloading valve needs adjusting or rebuild.

J. Main seal in press blown or cylinder damaged: inspect, repair as necessary.

P5. PRESS WILL RETRACT BUT NOT EXTEND (OR VISA-VERSA)

A. Problem with control valve; check for broken springs and blown gaskets.

B. Hose not properly connected; check quick-disconnect fittings.

C. Check valve on press cylinder not functioning.

D. Solenoid on pilot part of control valve burned-out; check and replace if necessary.

E. No power reaching solenoids; check circuit for breaks and short-circuits.

P6. SYSTEM OPERATES BUT DOES NOT REACH 10,000 PSI

A. Check pressure gauge for damage - use in-line test gauge; replace gauge if necessary.

B. Pressure switch damage - replace if necessary.

C. Pressure switch set too low - adjust as necessary.

D. Hydraulic leak; check control valve and inside the tank and the press itself.

E. Safety valve blowing-off prematurely - reset as necessary.

F. Low voltage - check as previously described.

G. Contaminated hydraulic fluid - clean out and replace.

H. Unloading valve needs adjusting or rebuilt.

P7. DIES STICKING

A. Use liquid soap on couplers more frequently (NOTE: brand new dies tend to stick more at first).

B. System pressure too high - set to 10,000 psi minimum (10,600 psi maximum).

C. Bite overhanging too much - adjust accordingly.

P8. COUPLER DOES NOT APPEAR TO HAVE BEEN FULLY SWAGED

A. Check pressure with test gauge.

B. Inspect dies for die wear using die profile gauge. Change dies if necessary.

C. Low pressure problem - See "P6" above.

15.0 TROUBLESHOOTING PE55 PUMP UNIT

The following problems (P1, P2, P3, etc.) and solutions (A, B, C, etc.) are intended for the benefit of knowledgeable and suitably capable technicians and maintenance personnel. DO NOT PROCEED TO MAKE REPAIRS WITHOUT CHECKING WITH THE MANUFACTURER. Always disconnect electrical power when making repairs.

P1. PUMP MOTOR WILL NOT RUN AT ALL

A. No power is reaching pump.
Check that power is being supplied to starter contacts. Check fuses or circuit breaker.

B. Broken start switch assembly.
Check operation with continuity meter.

C. Starter coil burned out.
Replace and locate short circuit before re-using.

P2. PUMP MOTOR WILL RUN BUT SHUTS-OFF FREQUENTLY

A. Circuit breaker trips.
Check rating. Check for short circuits.

B. Pressure switch loose.
Check adjustment. Tighten.

C. Bad connections, tears, breaks in power cord.
Inadequate power supply; replace power cord; check connections.

D. Damaged pump.
Results in high amperage and heat.

P3. PUMP MOTOR WILL RUN BUT NOTHING HAPPENS WHEN FOOT PEDAL IS DEPRESSED.

A. Broken hydraulic line inside the reservoir between the pump and the control valve; replace if necessary.

B. Broken shear-pins between motor and pump drive shaft; replace if needed.

C. Hydraulic control valve jammed or operation impaired; check for broken springs and blown gaskets.

D. Catastrophic failure of pump or pump components caused by contamination of the hydraulic fluid, water in the system or incorrect grade of hydraulic fluid; replace/repair as required.

E. No or low fluid level in tank - fill to bottom of filler screen. (If pump has had fluid change, it may be necessary to prime the pump.)

P4. PUMP RUNS BUT PERFORMANCE IS SLOW

A. Low voltage - check power source, voltage at the pump while under-load; power cord connections.

B. Hydraulic fluid contaminated with dirt, water or other substances; drain and clean tank; change the filter element; fill with new fluid.

C. Hydraulic fluid grade incorrect; use ISO viscosity Grade 46, high-pressure, anti-wear hydraulic fluid.

D. Strainer clogged - check and clean.

E. Hydraulic leak; check line inside the tank between pump and the control valve; check for any other external or internal leaks.

F. Broken seal and/or spring in control valve.

G. Fluid blowing across safety relief valve prematurely; adjust if necessary.

H. Unloading valve needs adjusting or rebuild.

I. Main seal in press blown or cylinder damaged: inspect, repair as necessary.

P5. PRESS WILL RETRACT BUT NOT EXTEND (OR VISA-VERSA)

A. Problem with control valve; check for broken springs and blown gaskets.

B. Hose not properly connected; check quick-disconnect fittings.

P6. SYSTEM OPERATES BUT DOES NOT REACH 10,000 PSI

A. Check pressure gauge for damage - use in-line test gauge; replace gauge if necessary.

B. Pressure switch damage - replace if necessary.

C. Pressure switch set too low - adjust as necessary.

D. Hydraulic leak; check control valve and inside the tank and the press itself.

E. Safety valve blowing-off prematurely - reset as necessary.

F. Low voltage - check as previously described.

G. Contaminated hydraulic fluid - clean out and replace.

H. Unloading valve needs adjusting or rebuilt.

P7. DIES STICKING

A. Use liquid soap on couplers more frequently (NOTE: brand new dies tend to stick more at first).

B. System pressure too high - set to 10,000 psi minimum (10,600 psi maximum).

C. Bite overhanging too much - adjust accordingly.

P8. COUPLER DOES NOT APPEAR TO HAVE BEEN FULLY SWAGED

A. Check pressure with test gauge.

B. Inspect dies for die wear using die profile gauge. Change dies if necessary.

C. Low pressure problem - See "P6" above.

NOTES:

Record of Lead Review

Document: Mac and Mac Work Instructions **Revision 0**

The signature below of the Lead Reviewer records that:
- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☐ **Engineering Review** ☒ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday John Holliday Civil/Structural 09/03/08
Lead Reviewer **(print/sign)** **Discipline** **Date**

Item No.	Deficiency	Resolution
1	NONE	

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

From: dave
To: Holliday, John;
cc: Burchett, Jon;
Subject: Re: Urgent Update
Date: Tuesday, September 02, 2008 6:02:54 PM

John:

1. The track frame is not mounted to the containment wall.

2. The size of the opening is 27' high and 26' wide (maximum) Revise accordingly as per August 19, 2008 email

3. 2,000,000 gallons of water at 45ppm TSS as per August 19, 2008 email

Thanks,

Dave MacNeil

----- Original Message -----
From: Holliday, John
To: dave@macandmac.com
Cc: Jopling, Daniel L. ; Bishara, Magdy M.
Sent: Tuesday, September 02, 2008 8:54 AM
Subject: Urgent Update

Dave,
Please revise Mac and Mac Work Instructions as follows:

1. under the heading "Hydrodemolition Concrete removal Track" .... Change to state that the track frame is not mounted to the containment wall.
2. The size of the opening is 27' high x 26' wide (maximum). Revise accordingly.
3. State in this document they need 2,000,000 gallons of water at 45ppm TSS.

I need this info by Thursday 9/4.

Thanks

John Holliday

MAC & MAC HYDRODEMOLITION SERVICES INC.

Suite D-13, 301 West Holly Street, Bellingham, WA 98225
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State of Washington Contractor License #MACMAHS996NB
State of California Contractor License #80

PROGRESS ENERGY SERVICE COMPANY, LLC
CRYSTAL RIVER THREE (CR3) NUCLEAR PLANT
CRYSTAL RIVER, FLORIDA

HYDRODEMOLITION WORK PLAN

PROJECT

Create a temporary opening in the CTMT wall removing all concrete using high pressure Hydrodemolition technology.

HYDRODEMOLITION EQUIPMENT

2 – 2000HP diesel pumping unit power packs. Each power pack contains 3 high pressure pumping units delivering 50 gpm @ 20,000 psi per pump to a Hydrodemolition nozzle mounted on the Hydrodemolition concrete removal track.

HYDRODEMOLITION CONCRETE REMOVAL TRACK

Stationed on access platform at temporary opening location. Track frame mounted on CTMT wall exterior outline of concrete to be removed 28' wide x 24' high.
Frame has two Hydrodemolition concrete manipulators mounted side by side, each covering 14' wide x 24' high
Each manipulator contains three Hydrodemolition nozzles. Each nozzle is connected to a high pressure pump in the power pack.

HYDRODEMOLITION PROCESS

Each manipulator passes over the surface removing concrete as it travels width wise one pass then index up 2 inches repeating the process until it reaches the top of the track (24' level). To prevent over cutting steel stops are installed at the 24' level.

When rebar is exposed manipulator is locked in place above the top (24') level while crews remove the rebar below. (Approx. 12 hours)
When rebar is removed Hydrodemolition resumes until Tendons are exposed. When tendons are exposed manipulators are locked in place above the top (24') level while crews remove and plug the tendons below. (Approx. 12 hours)

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State of California Contractor License #800844

When tendons are removed Hydrodemolition resumes until Liner plate is completely exposed.

When Liner plate is completely exposed Manipulators are locked in place until clear access is available to dismantle Frame.

RUBBLE CONTROL

As Hydrodemolition is in progress the water and concrete rubble will fall down to the platform into a chute running down to rubble and wastewater containers located on the ground.

To prevent rubble from escaping the immediate area a screen hoarding will be erected around the Hydrodemolition track.

HYDRODEMOLITION EQUIPMENT STAGING

2 active Hydrodemolition power packs to be setup approx. 400' from reactor opening location.
Three hoses will run from each power pack to the Hydrodemolition Track. =
2 – power packs = 6 hoses supplying two 3 nozzle manipulators mounted on the Hydrodemolition track.
1 backup power pack ready to operate less high pressure hoses will be staged also.

WATER CONTROL

Wastewater will be pumped from bins at the CTMT to wastewater treatment location in the staging area approx.400' away.
Discharged waste water will be:

- 6.0-9.0 PH
- Total suspended solids, 30ppm
- Oil in water, daily maximum of 18.4 ppm with a monthly average below 13.8 ppm
- List of all fluids, lubricants will be submitted for approval

ACTIVITIES

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- 6 months prior to commencing Hydrodemolition submit superintendent name for security clearance
- 2-3 months (to be determined) prior to commencing Hydrodemolition Mac & Mac superintendent arrives onsite
- 2 -3 months prior to commencing Hydrodemolition submit crew names for security clearance
- 3 weeks prior to commencing Hydrodemolition crew arrives for Security, Fitness-For-Duty, Health Physics, Badging, Setup equipment,
- 3 weeks prior to commencing Hydrodemolition, Hydrodemolition power packs, tracks, manipulators/robots, all accessories and supplies arrive on site.
- 3 weeks prior to commencing Hydrodemolition all wastewater equipment, tanks, pumps arrive on site
- 3 weeks prior to commencing Hydrodemolition all vacuum truck units arrive on site

THIRD WEEK BEFORE COMMENCING HYDRODEMOLITION

- Crew clearance completed (4 days)
- Stage Hydrodemolition power packs in Staging area approx. 400' from CTMT
- Stage and Assemble wastewater treatment facility in Staging area approx. 400' from CTMT

SECOND WEEK BEFORE COMMENCING HYDRODEMOLITION

- Run High Pressure lines to CTMT location
- Run Wastewater lines from CTMT to Staging area approx. 400' from CTMT
- Run fresh water line from source to Hydrodemolition power packs in staging area approx. 400' from CTMT
- Install trash pump at containment bin to pump water to treatment facility approx. 400' from CTMT
- Install piping from treatment center to settling pond
- Build berm around equipment in staging area

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ASSEMBLE HYDRODEMOLITION TOWER

- Assemble Tower on the ground outside of compound – small (60 ton) crane required for 3 days and a 8,000lb forklift
- Lift Assembled Tower onto chipping platform – crane required
- Bolt Tower Guide Legs onto chipping platform
- Run all hydraulic (water soluble oil), electrical, and pressure lines from Power Pack located outside of compound to Tower. (run lines under fence)
- Hookup high pressure hoses, hydraulic and electrical lines to Hydrodemolition manipulators (Manipulators are attached to the track. Track is attached to Tower)
- Place 125 ft. manlift in position
- Mount Hydrodemolition Control box in 125 ft. manlift bucket (Operator/Technician location / station)
- Test High pressure lines, electrical and hydraulic lines and controls
- Place 8' x 20' (2-8x10) sheets of steel on platform against reactor wall for testing system
- Test: Tower / Track system, High pressure system, hydraulic and electrical controls

ONE WEEK BEFORE COMMENCING HYDRODEMOLITION

- Complete projects (if any) not completed in week 2
- Fine tune all equipment
- Standby ready to begin Hydrodemolition 3 days prior to commencement date and time.

HYDRODEMOLITION COMMENCED

• Cutting Concrete removing 13% (13% of total)	4 Hours
• Remove rebar	12 Hours by others
• Cutting Concrete removing 17% (30% of total)	6 Hours
• Remove and plug tendons	12 Hours by others
• Cutting Concrete removing 23% (53% of total)	8 Hours
• Cutting Concrete removing 24% (77% of total)	8 Hours
• Cutting Concrete removing 13% (90% of total)	4 Hours
• Cutting Concrete removing 10% (100% of total)	4 Hours

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- Cutting concrete perimeter clean up allowance 8 hours
- Hydrodemolition Equipment Demob 2 Days
- Water Treatment Demob 4 Days

At all times Mac & Mac's project superintendent will keep Progress Energy representatives aware of our project progress and status.

PROGRESS ENERGY

NUCLEAR GENERATION GROUP

SPECIFICATION

CR3-C-0003

SPECIFICATION SUB-TYPE: CIV
PRIORITY CODE: 3

SPECIFICATION

FOR

CONCRETE WORK FOR RESTORATION OF THE SGR OPENING IN THE CONTAINMENT SHELL

FOR

☐ BNP UNIT 1 & 2

☒ CR3 ☐ HNP ☐ RNP ☐ ALL

REVISION 0
August 27, 2009

QUALITY CLASS: A

Prepared and Approved under EC 63016, Revision 5.

Contractor Signature Sheet

PROGRESS ENERGY

NUCLEAR GENERATION GROUP

SPECIFICATION

CR3-C-0003

SPECIFICATION

FOR

CONCRETE WORK FOR RESTORATION OF THE SGR OPENING IN THE CONTAINMENT SHELL

Revision: 0

This Specification was prepared for Progress Energy by:

Sargent & Lundy LLC
55 East Monroe Street
Chicago, IL 60603

S&L Project No. 10550-026

Contractor Signatures:

Prepared By: Chris Sward Date 08/27/09
Chris Sward

Reviewed By: Arthur Hall Date 8-27-09
Arthur Hall

Approved By: Chris Sward Date 08/27/09
Chris Sward

LIST OF EFFECTIVE PAGES

REVISION SUMMARY

Revision No.	Summary
0	Initial issue

TABLE OF CONTENTS

1.0 SCOPE

1.1 General

1.1.1 This document provides the specification for concrete to be used in restoring the containment shell after Steam Generator Replacement (SGR) at Crystal River 3 (CR3). This specification includes storage of constituent materials, batching, mixing, placing and curing of the concrete.

1.1.2 Crystal River 3 is scheduled to replace the existing Once-Through Steam Generators (OTSG) during refueling Outage 16 (RFO 16) in the fall of 2009. Replacement of the steam generators will require creation of an access opening through the concrete containment shell to facilitate removal of the existing generators and installation of new ones. Concrete used to restore the opening will be mixed at an on site batch plant from constituent materials stored on site.

1.2 Work Included

1.2.1 Progress Energy is responsible for all material, labor, logistical and technical resources, and coordination necessary for the complete execution of all work within this specification. This includes any required permits for industrial wastewater discharge, air emissions, or other requirements by the Florida Environmental Protection Agency or any other agencies.

1.2.2 All construction activity and testing of production concrete as prescribed herein is classified as Safety Related and shall be performed in accordance with a Quality Assurance Program meeting the requirements of 10CFR50 Appendix B.

1.3 Work by Others

1.3.1 Concrete proportioning and testing of the concrete constituent materials for this work was performed by others.

2.0 CODES, STANDARDS AND INDUSTRY DOCUMENTS

The following codes, standards and industry documents are part of this specification. When in conflict, the more restrictive requirements shall apply.

2.1 ACI - American Concrete Institute:

2.1.1 ACI 117-06 - Specifications for Tolerances for Concrete Construction and Materials.

2.1.2 ACI 211.1-91 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

2.1.3 ACI 301-05 - Specifications for Structural Concrete

2.1.4 ACI 305.1-06 -Specification for Hot Weather Concreting.

2.1.5 ACI 306.1-90 – Standard Specification for Cold Weather Concreting.

2.1.6 ACI 308.1-98 – Standard Specification for Curing Concrete.

2.2 ASME - American Society of Mechanical Engineers:

2.2.1 ASME Boiler and Pressure Vessel Code – Section III, Division 2, 2001 Edition with Addenda up to and including 2003.

2.3 ASTM - American Society for Testing and Materials:

2.3.1 ASTM C 31-09, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2.3.2 ASTM C 39-05, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

2.3.3 ASTM C 94-09, Standard Specification for Ready-Mixed Concrete.

2.3.4 ASTM C143-08, Standard Test Method for Slump of Hydraulic-Cement Concrete.

2.3.5 ASTM C 172-08, Standard Practice for Sampling Freshly Mixed Concrete.

2.3.6 ASTM C 231-09, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

2.3.7 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

2.3.8 ASTM C 511-09, Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in Testing Hydraulic Cements and Concretes.

2.3.9 ASTM C 566-97, Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.

2.3.10 ASTM C1064-08, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

2.3.11 ASTM C 1077-09, Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

2.3.12 ASTM C1602-06, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

2.3.13 ASTM D 512-04, Standard Test Methods for Chloride Ion in Water.

2.3.14 ASTM D 3867-09, Standard Test Methods for Nitrite-Nitrate in Water.

2.3.15 ASTM D 4658-09, Standard Test Method for Sulfide Ion in Water.

2.4 Other

2.4.1 U.S. Department of the Interior, Bureau of Reclamation, *Repair and Maintenance of Concrete*, Chapter 7.

2.4.2 NUA-NGGC-1530, Quality Assurance Hold Point Procedure.

2.4.3 MCP-NGGC-0401, Material Acquisition (Procurement, Receiving and Shipping)

3.0 TECHNICAL REQUIREMENTS

3.1 Constituent Materials

3.1.1 Constituent materials for concrete production shall be taken from site stores, which have been selected and dedicated for this use through a separate testing program.

3.1.2 Storage of Coarse Aggregates

Coarse aggregates should be controlled to minimize segregation. Aggregates shall be stored on a hard base with good drainage. Stockpiles should be built up in horizontal or gently sloping layers and not by end dumping. Trucks, loaders, and other equipment should not be operated on stockpiles in order to avoid breaking the aggregate and tracking dirt onto the piles. Avoid contamination of stockpiles and periodically remove any plants, growths, or other contaminants.

3.1.3 Storage of Fine Aggregates

Fine aggregates should be controlled to minimize variations in gradation, to keep finer fractions uniform and to avoid excess removal of fines during processing. Aggregates shall be stored on a hard base with good drainage. Protect dry, fine aggregates from being separated by the wind by using tarps or wind breaks. Provide adequate time for drainage of free water before transferring fine aggregates to the batch plant bins. Avoid contamination of stockpiles and periodically remove any plants, growths, or other contaminants.

3.1.4 Wetting of Aggregate Stockpiles

When wetting the stockpiles of coarse and fine aggregates, as is necessary to compensate for absorption or to provide cooling, aggregate shall be allowed to drain to reduce transfer of water not included in the mixing water. Determine the total evaporable moisture content in accordance with ASTM C566 any time the stockpiles are wetted and before placing aggregates in the batch plant bins to properly compensate for the mixing water content in the concrete mixture.

3.1.5 Cement

Cement shall be stored in weather tight structures to avoid absorption of moisture. For bulk cement, the interior of the cement silo shall be smooth, with a minimum bottom slope of 50 degrees from horizontal for a circular silo and 55 to 60 degrees for a rectangular silo. Each bin compartment from which cement is batched should include a separate gate, screw conveyor, air slide, rotary feeder, or other conveyance that allows constant flow and precise cutoff to obtain accurate batching of cement.

3.1.6 Fly Ash

Fly ash shall be handled, conveyed, and stored in the same manner as cement. The bins shall avoid cement contamination by fly ash prior to batching in the concrete.

3.1.7 Admixtures

Chemical admixtures that are delivered in liquid form shall be protected from freezing. If liquid admixtures are frozen, they should be properly reblended before they are used. Follow manufacture's recommendations. Long term storage of liquid admixtures in vented tanks should be avoided. Evaporation of the liquid could adversely affect the performance of the admixture.

3.1.8 Water and Ice

Mixing water and ice used in concrete production shall either be potable water or may be taken from a non-potable source that has been tested in accordance with ASTM C1602 Table 1 and Table 2.

3.2 Manufactured Materials

3.2.1 Curing Compound

Curing compound shall be membrane forming per ASTM C 309, Type 1 Class B. Product and manufacturer shall be as approved by Engineering.

3.2.2 Form Release Agents

Form Release Agents shall conform to Section 2.2.1.3 of ACI 301 and shall be applied to the formwork only. Form release agents shall not be applied or contaminate the steel liner, existing concrete surfaces, reinforcing bars, and tendon sheathing.

3.2.3 Bonding Agents

Organic bonding agents are not allowed. Existing concrete surfaces that will be in contact with new concrete shall be prepared as noted in Section 3.3 and Article 3.6.1.

3.3 Preparations for Placing Concrete

3.3.1 Existing concrete surfaces against which new concrete will be placed shall be roughened in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damage the concrete surface. The surfaces shall then be washed clean.

3.3.2 Before concrete is placed, clean the forms and reinforcing of dirt and debris, and do all necessary draining and pumping so that there is no standing water on horizontal surfaces. Do not place any concrete until forms and reinforcing have been inspected and accepted.

3.3.3 Existing concrete surfaces that will be in contact with new concrete shall be saturated for at least 24 hours prior to concrete placement. At time of placement there shall be no free water on the concrete surfaces (i.e., saturated surface-dry).

3.3.4 The existing concrete surface at the top of the access opening shall be sloped up toward the exterior surface of the wall with a slope to facilitate the escape of air. Before construction, a procedure shall be submitted for placing the concrete using a chimney and for the removal of the excess concrete in the chimney after hardening.

3.4 Mixing and Delivery of Production Concrete

3.4.1 Concrete shall conform to the requirements of this specification in addition to the requirements of ASTM C 94.

3.4.2 Concrete shall be mixed to the proportions shown in Table 1.

3.4.3 Admixtures 1 (plasticizer) and 2 (retarder) are provided in the mixture to increase the slump and extend workability (respectively). The quantities of these admixtures will need to be adjusted as batching and placement activities progress based on temperature and other conditions that affect slump. These admixtures may be added

after batching by addition directly to the delivery truck provided 1) total quantity of each admixture does not exceed the value in Table 1, and 2) the delivery trucks satisfy ASTM C94 requirements for mixing and are loaded accordingly.

3.4.4 Concrete shall be site mixed in a batch mixer. All concrete shall be mixed until there is a uniform distribution of materials. The mixer shall be rotated at a speed recommended by the manufacturer, and mixing shall be continued for not less than 1-1/2 minutes (for a 1 cubic yard batch) after all materials are in the drum. For batches larger than 1 cubic yard, mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

3.4.5 As-mixed concrete temperatures shall be maintained as low as practicable. A temperature control plan shall be developed, and approved by Engineering, that will assure that concrete is produced at a sufficiently low temperature such that the maximum temperatures prescribed in Section 3.5 will not be exceeded. Production methods for cooling the concrete shall be as identified in ACI 305.1 and shall be tested on trial mixes. This may include the use of liquid nitrogen, which can be injected into fresh concrete after batching. Injection shall be directly into the delivery truck with the mixer drum rotating to prevent pooling of nitrogen.

3.4.6 Concrete shall be conveyed by trucks equipped with an approved rotary drum or agitator. The mixer shall be discharged completely before recharging.

3.4.7 A delivery ticket shall be prepared for each load of concrete. Tickets shall indicate the mix identification, the number of yards delivered, the quantities of each material in the batch, the outdoor temperature in the shade, the time the cement and water were added, the numerical sequence of the delivery, and the maximum amount of admixtures that can be added before discharging the concrete. The ticket shall list the delivery truck number and the number of mixing drum revolutions at the time of the batch.

3.4.8 Each delivery truck shall be inspected at the point of discharge to have less than 300 revolutions on its rotary drum or agitator and to have been less than 90 minutes since water was added to the batch. When ambient temperature exceeds 80° concrete shall be discharged from the delivery truck within 30 minutes after the addition of water.

3.5 Testing of Production Concrete

3.5.1 Concrete shall be sampled and fresh concrete tests performed at the place of discharge from the concrete delivery trucks. Concrete samples shall be taken from five randomly selected trucks. The volume of each sample shall be enough to perform the fresh concrete tests and preparation of compression test specimens of hardened concrete as specified below.

3.5.2 Sampling of fresh concrete shall conform to ASTM C 172, except that requirements shall be modified to comply with the requirements of ASTM C 94.

3.5.3 Slump testing in accordance with ASTM C 143 shall be performed on each sample of fresh concrete secured. Slump shall be 6" min to 7" max. The maximum slump may be increased to 9" provided the lateral pressure on the concrete formwork is electronically monitored during placement and maintained less than or equal to 1300 psf.

3.5.4 Air content testing shall conform to ASTM C 231 and shall be performed on each sample of fresh concrete secured. Air content shall not exceed 3.5%.

3.5.5 Concrete temperature shall be measured at the point of discharge of each delivery truck. The temperature shall not exceed 75° F. If any temperature reading is below 70°F, the rate of placement shall be lowered and formwork pressures shall be monitored to ensure that the formwork design limit of 1300 psf is not exceeded.

3.5.6 A set of (12) twelve standard 6" by 12" cylinder specimens shall be cast from each fresh concrete sample. Cylinder specimens shall be cast and cured in accordance with ASTM C 31 except that the cylinders shall be sealed so as not to allow access to moisture. Eight cylinders will be designated for strength testing as noted in Section 3.5.7 and four cylinders will be remain as spares.

3.5.7 Compression strength tests shall be performed on the cylinders cast above in accordance with ASTM C 39 at 3, 5, 28, and 91 days. Each strength test shall consist of two cylinders from the same sample. If one cylinder shows evidence of improper compaction or curing, or the measured strength is less than 1500 psi, one of the extra cylinders from the same sample shall also be tested. Report findings on all concrete strengths, but the average strength reported for the sample shall not include any defective cylinders tested.

3.5.8 The recorded field data shall be forwarded to the Testing Laboratory along with the cured concrete cylinders for testing.

3.6 Placing Concrete

3.6.1 Immediately before fresh concrete is deposited, the horizontal surface of the existing concrete in the bottom of the access opening shall be thoroughly covered with a sand/water/cement mortar of the same mix as concrete to be poured for a depth of ½ to 1 inch. Fresh concrete shall then be placed before cement mortar has obtained its initial set. Alternatively, if no mortar bedding is provided, the drop height requirements of Section 3.6.4 shall be reduced to 2 feet.

3.6.2 Convey concrete to the place of final deposit within fifteen minutes after discharge from the truck if the ambient temperature exceeds 80° F. Concrete shall be placed within 30 minutes from discharge if the ambient temperature is 80° or less.

3.6.3 Chutes or other equipment for conveying concrete shall be of such size and design as to insure a continuous flow of concrete at the delivery end without separation of ingredients, and shall be thoroughly cleaned before each run. Concrete, during conveyance, shall not come in contact with aluminum.

3.6.4 Concrete shall not be allowed to drop freely more than 5 feet (2 feet if mortar bedding is not provided per Article 3.6.1). These limits shall be attained by using a hopper and drop chute. The stream of concrete shall not be separated by falling freely over rods, reinforcement, or tendon ducts. Concrete should be deposited at or near its final position to avoid segregation when it has to flow laterally into place.

3.6.5 Concrete shall be placed in layers approximately 18 inches thick, in accordance with ACI 301 provisions for mass concrete. Concrete shall not be deposited at a rate to exceed a vertical height in the form of 4 feet per hour. Alternatively, formwork pressure shall be electronically monitored to ensure that the formwork design limit of 1300 psf is not exceeded.

3.6.6 Place all concrete in a continuous and uninterrupted operation in such manner as to form a monolithic structure, the component parts of which are securely bonded together.

No concrete shall be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within a given section. Do not deposit segregated concrete or concrete that has partially hardened or been contaminated by foreign materials, nor use retempered concrete. Time interval between placing of successive batches of concrete shall not be greater than 30 minutes.

3.6.7 Thoroughly consolidate each layer of concrete before placing the next layer by means of internal mechanical vibrators. Internal vibrators shall conform to Section 5.3.2.5 of ACI 301. Vibrators shall be tested the day before the placement, and spare vibrators shall be available in case of vibrator failure during placement of concrete.

3.6.9 Should a cold joint become necessary, the fresh concrete should be fairly leveled and reasonably rough. After hardening, any laitance or soft mortar should be removed and the sand and sound surface mortar exposed on the surface by sandblasting or high-pressure water jetting. The surface shall then be cleaned and prepared as outlined in Section 3.3 and Article 3.6.1.

3.6.10 Concrete at the top of the placement against the top surface of the containment shell opening shall be placed by use of a chimney and pressure applied during final vibration as described in Chapter VII of "Repair and Maintenance of Concrete" of the U.S. Department of the Interior, Bureau of Reclamation, "for concrete placement in concrete wall repairs to prevent any air pockets.. concrete surface."

3.6.11 Cold Weather Placement:

a. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as herein specified.

b. The use of frozen materials or materials containing ice or snow IS NOT PERMITTED.

c. Do not use calcium chloride, salt or other materials containing antifreeze agents.

3.6.11 Hot Weather Placement:

When hot weather conditions exist that would impair the quality and strength of concrete, place concrete in compliance with ACI 301, ACI 305.1-06 and as herein specified.

3.7 Curing and Protection of Concrete

3.7.1 Concrete shall be cured and protected for a minimum of 7 days in accordance with the requirements of Section 8 of ACI 301.

3.7.2 Protect freshly placed concrete from premature drying, excessive heat or cold, and mechanical injury. Protection shall be maintained such that the maximum decrease in temperature at the concrete surface does not exceed 20° F in a 24 hour period.

3.7.3 During hot weather, keep forms and exposed concrete continuously wet during the curing period whenever the surrounding air temperature is above 90° F. Metal forms need not be wetted but precautions shall be taken to prevent heating of the forms from solar radiation.

3.7.4 During cold weather, the temperature of the concrete surface shall be protected to maintain a temperature of 40° F for a minimum period of the first three days. The housing or covering of concrete for cold weather protection and the means of providing artificial heat shall be in accordance with ACI 306.1. Such housing or covering shall remain in place and intact for at least 24 hours after artificial heating is discontinued.

3.7.5 Insulation blankets of sufficient thickness, thermocouples, etc., shall be used as required to maintain the surface temperature of the concrete in accordance with ACI 301 provisions for mass concrete. Do not use steam or other curing methods that will add heat to the concrete.

3.7.6 Avoid rapid drying at the end of the final curing period.

3.7.7 When forms are stripped before completion of the specified curing period, apply membrane forming curing compound uniformly in a two-coat continuous operation by means of power spray equipment in accordance with manufacturer's directions. Recoat areas which are subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Liquid membrane forming curing compounds shall conform to the requirements of Section 3.2.1.

3.7.8 Tensioning of the reinforcing tendons shall not take place until the concrete has achieved a compressive strength (f'_c) of 5000 psi as determined by Engineering following the acceptance standards of ACI 301.

3.8 Form Removal and Finishing

3.8.1 Formwork may be removed after 3 days. Forms may be removed sooner if the concrete has achieved a compressive strength of 3000 psi as demonstrated through strength testing conducted in accordance with Article 3.5.7. Spare cylinder specimens from Article 3.5.6 may be used for this testing.

3.8.2 Methods used for removal of formwork shall be such as to prevent marring, breakage or other damage to concrete. Removal of formwork shall conform to the applicable requirements of ACI 301.

3.8.3 Upon removal of forms, the concrete surface shall be finished such that all fins and other projections are removed and offsets leveled. All voids, honeycomb or other defective concrete surfaces shall be repaired as follows:

a. Defective concrete cut and removed down to solid concrete.

b. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges.

c. Prepared surface should not extend to a depth that exposes rebar. For repaired surface that are deep enough to expose reinforcement a separate repair plan will be required.

d. Dampen the area to be patched plus another 6 inches around the patch area perimeter for at least 2 hours.

e. Use a bonding grout that is approximately one part cement and one part fine sand mixed with water to a consistency of thick cream, and thoroughly brush into the

surface.

f. When the bond coat begins to lose water sheen, apply patching mortar prepared using the same materials as the concrete except with no coarse aggregate. Fly ash and admixtures are not required in the mortar if the repaired surface does not expose reinforcement.

g. Thoroughly consolidate the mortar into place.

h. Strikeoff mortar, leaving the patch slightly higher than the surrounding surface to compensate for shrinkage. Leave the patch undisturbed for one hour before finishing.

j. Keep the patch damp for seven days.

3.8.4 For tie holes, clean the hole and saturate with water and pack with cement mortar of the same composition as that used in the concrete. The mortar should use the same sand and water used in the concrete and mixed as dry as practicable, with just enough water so that it will be tightly compacted when forced into place. Do not use more than one part cement to 2 ½ parts sand by damp loose volume. Admixtures and fly ash are not required.

3.8.5 The concrete shall be finished free from streaks, discolorations or other imperfections as to produce an extremely smooth, dense and true finish of uniform color.

3.9 Concrete Testing Laboratory

3.9.1 On-site and off-site facilities used for testing shall be operated under an approved 10CFR50 Appendix B program.

3.9.2 Personnel performing and supervising field and laboratory testing shall meet the experience and certification requirements of ASTM C1077.

4.0 DOCUMENTATION REQUIREMENTS

4.1 Batch tickets, results of field tests, and concrete strength tests shall be collected and reported. Strength test reports will include the batch ticket number and detailed information on the storage and curing of the specimens before testing.

5.0 QUALITY ASSURANCE AND CONTROL REQUIREMENTS

5.1 Concrete constituent materials (except water and ice) shall be acquired in accordance with MCP-NGGC-0401 except as herein specified. The concrete constituents shall be classified as material quality level 2 – Commercial Grade Item and dedicated per this procedure.

5.2 The concrete batch plant shall have a current certification from the National Ready Mix Concrete Association (NRMCA).

5.3 Personnel performing concrete inspection and testing shall be qualified in accordance with ASME Section III, Division 2 Subsection CC-5130 and Appendix V.

5.4 Concrete inspection shall include the activities listed in NUA-NGGC-1530, Attachment 2 sheet 25, except concrete pouring shall be continuous and not interrupted for QC activities. Inspection personnel shall be present throughout the pour to perform tests and monitor construction.

Table 1
CONCRETE PROPORTIONING
FOR RESTORATION OF THE CONTAINMENT SHELL

Mix Specifications:

Strength:	6000 psi at 5 days, 7000 psi at 28 days
Slump:	6" to 9"
Air Entrainment:	0% to 3.5% maximum
Concrete Unit Wt:	145 pcf minimum

Mix Proportioning:

Constituent	Quantity	Material	Source	Notes
Cement	560 lbs	Type 1 Portland cement	Holcim (US) Inc. Holly Hill Plant 200 Safety Street/Highway 453 P.O. Box 698 Holly Hill, SC 29059	
Flyash	140 lbs	ProAsh Class F	Separation Technologies LLC 1616 Roanoke Rd P.O. Box 549 Daleville, VA 24083	
Coarse Aggregate	1613 lbs	No. 67 Stone	Vulcan Materials Company Maryville Quarry 2201 Duncan Road Maryville, TN 37803	ASTM C33 coarse aggregate for concrete. No. 67 is a ¾" gradation limestone with a specific gravity of ~2.8 and SSD of 2.82.
Sand	1515 lbs	--	B. V. Hedrick Gravel & Sand Lilesville Quarry Lilesville, NC	Mainly a natural silica sand with an addition of crushed granite to raise the FM to ~2.80.
Water	262.5 lbs	See note*	On site source	* Use potable water or non-potable water that has been tested for conformance with ASTM C1602.
Admixture 1	Note 1	ADVA Cast 575	W.R.Grace & Co. - Conn 62 Whittemore Avenue Cambridge, MA 02140	High range water reducer. Polycarboxylate-based ASTM C494 Type F and ASTM C1017 Type I plasticizer.
Admixture 2	Note 2	Recover	W.R.Grace & Co. - Conn 62 Whittemore Avenue Cambridge, MA 02140	Hydration stabilizer. Aqueous solution of hydroxycarboxylic acid salts and compound carbohydrates. ASTM C494 Type D retarder.

Note 1 – Dose plasticizer as required to achieve desired slump but do not exceed manufacturer's recommendation of 10oz/cwt.
Note 2 – Dose retarder as required for desired slump retention but do not exceed 2oz/cwt.

ATTACHMENT 1

LABORATORY TESTING REQUIREMENTS FOR CONCRETE PROPORTIONING

The attached specification document was produced to develop a testing program through which the concrete proportioning of Table 1 was established. It is included herein for historical and reference purposes only.

PROGRESS ENERGY

LABORATORY TESTING REQUIREMENTS FOR CONCRETE PROPORTIONING

FOR

CRYSTAL RIVER 3
STEAM GENERATOR REPLACEMENT
RESTORATION OF THE CONTAINMENT OPENING

REVISION: 3

NUCLEAR SAFETY RELATED

by Sargent & Lundy
Preparer: Chris Sward
Reviewer: Domingo Carreira

07/01/08

Crystal River 3
Steam Generator Replacement

Laboratory Testing Requirements
For Concrete Proportioning
Rev. 3

LIST OF EFFECTIVE PAGES

REVISION SUMMARY

Revision 0 – Initial Issue

Revision 1 – Revised Articles 2.1.1, 3.2.1, 3.2.2, 3.2.6, 3.4.5, 3.4.6, 3.7.1.1, and 3.7.3.1 and Article 3.5.1.2 was modified and moved to Section 3.6.4 to resolve bidder questions.

Revision 2 – Revised Articles 1.1.3, 1.1.4, 1.3.1, 1.3.2, 1.3.3, 1.4.1, 1.4.2, 1.4.3, 1.5.1, 2.1.1, 3.2, 3.3, 3.4.4, 3.5, 3.6, 3.8.3.1, and 3.8.5.1.c. The changes have been instigated to reduce the number of potential samples to be tested in each phase and to eliminate some testing in an effort to reduce the cost of the testing program.

Revision 3 – Revised the testing approach in order to shorten the overall testing schedule. Revised Articles 1.1.3, 1.1.4.b, 1.3.1,a, 1.3.1.c, 1.3.1.e, 1.3.2.b, 1.3.3.b, 1.3.3.c, 1.4, 1.5.1, 1.5.2, 2.1.1, 3.2.2, 3.2.5, 3.2.6, Table 1, and 3.8.2.1 and added Attachment A.

TABLE OF CONTENTS

ATTACHMENTS

1.0 GENERAL

1.1 Background

1.1.1 This document provides the scope of work and technical requirements for the Testing Laboratory to test concrete materials and mixtures to support and develop mixture proportioning for concrete to be used in the restoration of an opening in the containment building at the Crystal River Unit 3 (CR3) nuclear power plant, located near Crystal River, Florida.

1.1.2 Crystal River Unit 3 is scheduled to replace the existing Once-through Steam Generators (OTSG) during Refueling Outage 16 (RFO16) in the fall of 2009. Replacement of the steam generators will require creation of an access opening through the containment shell to facilitate removal of the existing generators and installation of new ones. Restoration of the opening requires development of concrete mixture proportioning that will produce a concrete that will meet the required physical properties (strength, density, elastic modulus, creep and shrinkage, durability, etc.) and provide appropriate characteristics for placeability in the subject application (workability, consistency, no segregation, and no bleeding). Additional considerations are required to achieve high early strength to permit tendon stressing as soon as practical after placement, and to maintain physical compatibility with the existing concrete by limiting the creep and shrinkage strains of the concrete.

1.1.3 A three-phased testing plan will be implemented.

a. The first phase will involve standard testing of alternative constituent materials for the purpose of commercial grade dedication and for identifying which are most likely to produce concrete with the required properties.

b. The second phase will develop preliminary mixes and perform limited testing for the purpose of honing in on two mixture proportions with the best performance. Standard testing of fresh and hardened concrete will be performed for the two trial mixtures for the purpose of selecting a mixture with the best likelihood of producing a concrete mix that will meet the requirements for fresh concrete and the design requirements for strength, creep and shrinkage, and elastic modulus. From the results of the Phase 2 work, one mixture design will be selected in consultation with Progress Energy and their A/E.

c. The third phase will consist of confirmatory testing on the selected mixture design including creep and shrinkage testing to confirm acceptability for the intended application.

d. The first and third phase testing will form part of the dedication process for the concrete and its constituent materials for use in a nuclear safety-related application.

1.1.4 The requirements for the fresh concrete are as follows:

a. Maximum temperature as mixed shall not exceed 50°F.

b. Unit weight shall be at least 145 lbs per cubic foot.

c. Air content shall not exceed 2.5%.

d. Bleeding shall not be measurable.

e. Slump shall be 4 ± 1 inch.

1.1.5 The design requirements for the hardened concrete are as follows:

a. Compressive strength shall be at least 6000 psi at 5 days and 7000 psi at 28 days.

b. The ultimate creep coefficient, ϕ_u, shall not exceed 1.5.

1.2 Laboratory Qualification

1.2.1 The testing laboratory shall be accredited in compliance with ASTM C1077.

1.3 Work Included

1.3.1 Phase 1, Trial Mixture Proportioning, will include the following activities by the Testing Laboratory:

a. Development of a Test Plan as outlined in Section 3.8.2.

b. Receipt, labeling and storage of constituent materials from individual suppliers.

c. Testing of constituent materials as stipulated in Section 3.2. Up to two different materials of each type (i.e., coarse aggregate, fine aggregate, cement, fly ash, silica fume, and water reducing admixtures) will be tested.

d. Analyze test results and make recommendations relative to trial mixture proportioning.

e. Development of the Phase 1 Test Report as outlined in Section 3.8.3.

1.3.2 Phase 2, Trial Mixture Testing, will include the following activities by the Testing Laboratory:

a. Development of a Test Plan as outlined in Section 3.8.2.

b. Concrete tests as stipulated in Sections 3.5 and 3.6 for each trial concrete mixture. Two different mixture designs will be tested.

c. Analyze test results and make recommendations relative to selection of the preferred mixture proportioning.

d. Development of the Phase 2 Test Report as outlined in Section 3.8.4.

1.3.3 Phase 3, Acceptance Testing, will include the following activities by the Testing Laboratory:

a. Development of a Test Plan as outlined in Section 3.8.2.

b. Concrete tests as stipulated in Sections 3.5 and 3.6 for one mix design.

c. Creep and shrinkage testing as stipulated in Section 3.7.

d. Development of the Final Test Report as outlined in Section 3.8.5.

1.4 Work by Others

1.4.1 Material samples for testing will be provided by material suppliers listed in Attachment A from material supplies procured by Progress Energy and stored at the CR3 site. This will include the following:

a. Coarse aggregate,
b. Fine aggregate,
c. Cement,
d. Fly ash,
e. Silica fume,
f. Chemical admixtures; including polycaboxylate-based high range water reducing and superplasticizer admixtures.

1.5 Quality Assurance

1.5.1 Phase 2 work is classified as Non Safety-Related and can be performed by the Testing Laboratory in accordance with practices and procedures in ASTM and other standards in this specification.

1.5.2 Phase 1 and 3 work is classified as Safety-Related and shall be performed in accordance with a Quality Assurance Program meeting the requirements of 10CFR50 Appendix B.

2.0 REFERENCES

2.1 Codes, Standards and Industry Documents

2.1.1 American Society for Testing and Materials, (ASTM) – Code editions for the listed standards as well as any standards referenced therein shall be as provided in the 2007 book of standards.

a. ASTM C 29 Test Method for Bulk Density (Unit Weight) and Voids in Aggregate,

b. ASTM C 33 Standard Specification for Concrete Aggregates,

c. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens,

d. ASTM C 138 Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete,

e. ASTM C 143 Standard Test Method for Slump of Hydraulic-Cement Concrete,

f. ASTM C 150 Standard Specification for Portland Cement,

g. ASTM C 192 Standard Practice for Making and Curing Test Specimens in the Laboratory,

h. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by Pressure Method,

i. ASTM C 469 Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression,

j. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete,

k. ASTM C 512 Standard Test Method for Creep of Concrete in Compression,

l. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete,

m. ASTM C 642 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete,

n. ASTM C 684 Standard Test Method for Making, Accelerated Curing and Testing Concrete Compression Test Specimens,

o. ASTM C 1064 Standard Test Methods for Temperature of Freshly Mixed Portland Cement Concrete,

p. ASTM C 1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation,

q. ASTM C 1157 Standard Specification for Hydraulic Cement,

r. ASTM C 1240 Standard Specification for Use of Silica Fume as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar and Grout,

2.1.2 American Concrete Institute, (ACI):

a. ACI 211.1-91 R-02 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete,

b. ACI 211.4 R-93 Guide for Selecting Proportions for High-Strength Concrete with Portland Cement and Fly Ash.

2.1.3 US Army Corps of Engineers Concrete Research Division (CRD):

a. CRD-C 36 Handbook for Concrete and Cement Method of Test for Thermal Diffusivity of Concrete.

2.1.4 Paper SP 194-12 by D.J. Carreira and R.G. Burg, "Testing for Concrete Creep and Shrinkage," in the ACI Special Publication 194, The Adam Neville Symposium: Creep and Shrinkage—Structural Design Effects, American Concrete Institute, 2000, pp.381-420.

3.0 EXECUTION

3.1 Receipt & Storage of Constituent Materials

3.1.1 The Testing Laboratory shall receive, label and properly store all concrete constitutive materials to prevent their contamination and degradation with time.

3.1.2 All materials not used in the testing shall be stored for further testing if needed. Upon completion of the testing program the Testing Laboratory will dispose all unused materials, unless otherwise required by Progress Energy.

3.2 Testing of Constituent Materials

3.2.1 Coarse aggregate shall be sampled and tested for conformance to ASTM C 33. Testing in accordance with ASTM C 29 is of importance, since concrete will be designed to maximize unit weight and modulus of elasticity and minimize creep and shrinkage.

3.2.2 Fine aggregate shall be sampled and tested for conformance to ASTM C 33. Testing in accordance with ASTM C 29 is of importance, since concrete will be designed to maximize unit weight and modulus of elasticity and minimize creep and shrinkage.

3.2.3 Cement shall be sampled and tested for conformance to ASTM C 150 Type I or Type III cement, including the Optional Composition Requirements (Table 2) and Optional Physical Requirements (Table 4). Cement conforming to ASTM C 1157, but not conforming to ASTM C 150 is not acceptable, regardless of additions included and shall be reported immediately to Progress Energy.

3.2.4 Fly ash shall be sampled and tested for conformance to ASTM C 618 including the Supplementary Optional Physical requirements for the following:

a. Multiple factor.

b. Effectiveness in controlling Alkali-silica reaction if appropriate based on findings in Article 3.2.2.

3.2.5 Chemical admixtures shall be tested to confirm that they do not contain more than 1% by volume of chloride ions.

3.2.6 Silica fume shall be tested for conformance to chemical and physical requirements of Tables 1 and 2 of ASTM C 1240.

3.2.7 Potable water will not be tested by the Testing Laboratory.

3.3 Mixture Proportioning Design

3.3.1 Concrete mixture proportioning shall be based on but not limited to the applicable methods in ACI 211.1 and ACI 211.4.

3.3.2 Concrete mixture proportioning shall be designed for the following attributes:

a. Maximize the absolute volume of the aggregate, while reducing water content.

b. Water-to-cementitious materials not exceeding 35% by weight.

c. Maximize the concrete modulus of elasticity.

d. Produce a mixture to be consolidated by internal vibration.

e. Use of chemical admixtures to reduce as much as possible the water and cementitious material contents in the concrete.

f. Meet all the fresh and hardened concrete requirements described in Section 1.1.4 and 1.1.5.

3.4 Preparation of Test Specimens

3.4.1 Concrete making and batching shall conform to ACI 211.1.

3.4.2 The preparation of test specimens shall conform to ASTM C 192.

3.4.3 All specimens required for testing of a concrete mixture shall be obtained from a single batch. At least three additional cylindrical test specimens shall be prepared from each batch in case some cylinders show defects that invalidate results.

3.4.4 Cylindrical test specimens meeting the requirements of ASTM C 512 shall be prepared for each concrete mixture in the quantities indicated in Table 1. Additional specimens are specified in case some cylinders are found to be defective.

Table 1 - Minimum Number of Specimens Required

Test		No. of Specimens	
		Phase 2 (per mixture)	Phase 3
Compressive Strength	5 days	2	2
	28 days	2	2
Static Modulus of Elasticity	5 days	2	2
	28 days	2	2
Shrinkage	sealed	--	2
	unsealed	--	2
Creep	sealed	--	2
	unsealed	--	2
Additional	sealed	--	1
	unsealed	2	1
Total		10	18 (5 sealed)

3.4.5 All test specimens shall be cured for 5 days in accordance with ASTM C 684, Procedure C - Autogenous Method.

3.4.6 Following the initial 5-day curing,

3.4.6.1 Phase 2 test specimens shall continue in the curing environment specified in Section 8.3 of ASTM C 192.

3.4.6.2 Creep and shrinkage test specimens shall be moved to the controlled testing environment (see Article 3.7.2). For these specimens, the curing period may be shortened up to 5 hours as necessary for test preparation and acclimatization of the specimen to the test environment (reference Article 3.7.2).

3.4.7 Under no circumstances shall test specimens be cured by immersion in water. For comparison purposes cylinders may be cured in their sealed molds in accordance with ASTM C 192 until testing in compression.

3.5 Testing of Fresh Concrete

3.5.1 Each batch of freshly mixed concrete shall be tested for the following:

3.5.1.1 Maximum temperature as mixed, when tested in accordance with ASTM C 1064. To reduce concrete temperature to 50°F maximum will require the use of crushed ice replacing a significant portion of the mixing water and cooling of the material components prior to mixing.

3.5.1.2 Unit weight shall be tested in accordance with ASTM C 138.

3.5.1.3 Air content shall be tested in accordance with ASTM C 231.

3.5.1.4 Slump shall be determined in accordance with ASTM C 143.

3.6 Testing of Hardened Concrete for Compressive Strength & Modulus of Elasticity

3.6.1 Test specimens of hardened concrete shall be tested at 5 and 28 days for compressive strength in accordance with ASTM C 39.

3.6.2 Test specimens of hardened concrete shall be tested at 5 and 28 days for static modulus of elasticity in accordance with ASTM C 469.

3.6.3 One test specimen slated for 28 day testing shall be tested for temperature rise in accordance with CRD-C 36.

3.6.4 For Phase 3 concrete mixes, after the week of creep recovery readings (Article 3.7.4.7), determine the static modulus of elasticity and compressive strength on the creep and shrinkage test specimens.

3.6.5 For Phase 3 concrete mixes, total evaporable water shall be tested in accordance with ASTM C 642 using the remnants of specimens tested for compressive strength at 5 days.

3.7 Testing of Hardened Concrete for Creep and Shrinkage

3.7.1 General

3.7.1.1 The concrete mixtures selected for testing for creep and shrinkage shall be tested in accordance with ASTM C 512 as modified herein. Reference 2.1.4 provides background and guidance on the required testing program.

3.7.1.2 Shrinkage deformation shall be measured in accordance with ASTM C 512. Autogenous shrinkage will be determined from the two sealed specimens. Total shrinkage will be determined from the two non-sealed specimens.

3.7.1.3 Total deformation under sustained load, including instantaneous, basic and drying creep strains, as well as the elastic and creep recovery after creep testing, shall be measured in accordance with ASTM C 512. Basic creep will be determined from the two sealed specimens. Total deformation, including basic and drying creep strains, will be determined from the two non-sealed specimens.

3.7.2 Testing Environment

3.7.2.1 The testing environment shall be maintained at 73.4 ± 2.0°F and a relative humidity of 50 ± 4% (i.e., standard drying environment specified in ASTM C 512 Section 6.1) until completion of the test.

3.7.3 Loading of Creep Specimens

3.7.3.1 A sustained load of 2000 psi shall be applied at 5 days ± 1 hour from the time that the specimens were molded.

3.7.3.2 The sustained load shall remain applied during at least 91 days, or to a later date if necessary, depending on the test results. The Testing Laboratory shall contact Progress Energy at least three weeks before the end of the 91 days, if it is considered necessary to continue creep testing beyond 91 days.

3.7.4 Deformation Measurements

3.7.4.1 If external devices are used for measurement, strains shall be measured on three gage lines spaced uniformly around the specimen.

3.7.4.2 Time zero for strain readings shall be the instant when the sustained load is fully applied (see Article 3.7.3.1) or when drying starts for the shrinkage specimens.

3.7.4.3 The minimum number of creep and shrinkage deformation measurements for each one of the creep and shrinkage specimens in a test set shall be as follows:

Before loading:
- Immediately before specimens start drying
- Immediately before loading

During first day after loading:	• Within 1 minute after loading if electronic strain gages are used
	• Within 5 minutes
	• At 15 to 20 minutes
	• At one hour
	• At 2 hours 45 minutes
	• Between 6 and 8 hours
First week:	• Daily within ± ½ hour of the time of loading
After first week:	• Weekly

3.7.4.4 Measurements with mechanical strain gages shall be completed along the three gage lengths on each test specimen, before taking the readings on any other specimens in the creep frame. The readings on each specimen should be taken within two minutes and the time of reading reported for each specimen individually.

3.7.4.5 The time of measurement readings shall be recorded to the nearest minute, and reported as a fraction of a day rounded to the nearest 0.0007 of a day. This precision is important for the readings taken during the first hours and days after loading, unloading or reloading, and after drying starts. Significant errors are introduced in the test data when the initial readings are reported rounded as a full day or half-a-day on the first day or even to the hour during the first few hours after loading.

3.7.4.6 The strain readings shall be plotted within the hour of measurement and evaluated to detect irregularities or inconsistencies. Additional readings shall be taken immediately if irregularities or inconsistent reading are detected.

3.7.4.7 Elastic recovery shall be measured at the time the sustained load is removed. Creep recovery shall be measured for at least a week after load removal.

3.8 Submittals

3.8.1 Quality Assurance Program

3.8.1.1 The Testing Laboratory shall submit their Quality Assurance Program to Progress Energy for review and approval one month prior to commencement of Phase 3 activities.

3.8.2 Test Plan

3.8.2.1 The Testing Laboratory shall submit Test Plans for Progress Energy approval. The test plan shall include the following information as a minimum:

a. Standards to be used for testing, indicating exceptions taken and additional requirements or conditions.

b. Test procedures to be used.

c. Description of test specimens including shape, sizes, type of molds used, end surface preparation method, end surface sealant and membrane system on the sealed specimens.

d. Description of the creep testing frames.

e. Description of the testing environment and environmental controls.

f. Description of the methods and equipment to be used for strain measurements.

3.8.2.2 Comments from Progress Energy or their agent shall be resolved and incorporated into the Test Plan prior to the initiation of any testing.

3.8.3 Phase 1 Test Report

3.8.3.1 Within 2 weeks after completion of Phase 1 testing, the Testing Laboratory shall provide a Test Report to Progress Energy for review. The Test Report shall include the following:

a. Certified test results for constituent materials.

b. Recommended concrete proportioning.

3.8.4 Phase 2 Test Report

3.8.4.1 Within 2 weeks after completion of Phase 2 testing, the Testing Laboratory shall provide a Test Report to Progress Energy for review. The Test Report shall include the following:

a. Description of the mixing and testing equipment used, including calibration documents.

b. Concrete mixture proportions, mixing time, properties of the fresh concrete, compressive strength, and static and dynamic moduli of elasticity for each of the concrete mixes.

3.8.5 Final Test Report

3.8.5.1 Within 3 weeks after completion of Phase 3 testing, the Testing Laboratory shall provide a test report that includes the following data as a minimum:

a. Laboratory accreditation and names, qualification and initials of testing personnel, and the extent of their involvement in the testing program.

b. Description of the mixing and testing equipment used, including calibration documents.

c. Concrete mixture proportions, mixing time, properties of the fresh concrete, compressive strength, and static modulus of elasticity at the time of loading, at 28 days and at the conclusion of the creep and shrinkage testing.

d. Detailed description of the curing and environmental conditions, including temperature and relative humidity records.

e. Description of length measuring devices, gage points, gage lengths and strain gages used or electronic transducers and data acquisition system.

f. Certified test results for constituent materials.

g. Test schedule including concrete age at loading and the age drying started, and applied stresses.

h. Gage or strain measurements with the time when taken and the initials of the personnel that took them. Computed strains with a description of how they were processed. An electronic file of all test data shall be provided.

i. Explanation of unexpected irregularities, inconsistencies and deviations in the data.

j. Graphic representation of all test results with strain readings plotted on a log-time scale.

3.9 Communication

3.9.1 During the testing program, the Testing Laboratory shall maintain regular periodic communication with Progress Energy and their representatives. This communication will review in-process data and help to identify unexpected results. It will also provide an ongoing evaluation of the objectives of the program and decisions on the concrete mixture proportions and its properties.

Concrete Constituent Materials for Laboratory Testing

Constituent	Description/Requirements	Supplier	Notes
Cement	ASTM C150 Type 1 or Florida DOT cement with a normal or higher than normal content of SO_3, a cube strength at 3 days of at least 3900 psi, including the Optional Composition Requirements (Table 2), and Optional Physical Requirements (Table 4). Cement conforming to ASTM C 1157, but not conforming to ASTM C 150 is not acceptable, regardless of additions included. A certified material test report shall be provided. This cement will be tested for full conformance to ASTM C 150.	**1. Holcim (US) Inc.** Artesia Plant PO Box 185 8677 Highway 45 South 45 Alternate Artesia, MS 39736 Phone: 800-292-4355 662-272-5121 Fax: 662-272-6012 Contacts: T. Cash 601-955-1622 Mr. Rutherford 662-272-5121	Compressive strength of Florida DOT cement at 3 days is 3930 psi, with the 7 days heat of hydration is 73 Cal/g. The Type I strength at 3 days is 3940 psi and the7 days heat of hydration is 71 Cal/g. No advantage in using Type I cement from this plant.
		3. Holcim (US) Inc. Holly Hill Plant PO Box 698 200 Safety Street/Highway 453 Holly Hill, SC 29059 Phone: 803-496-5027 Fax: 803-496-2733	Compressive strength of the Type 1 at 3 days is 4240 psi.
Coarse Aggregate	ASTM C33 coarse aggregate for concrete. No. 67, ¾" gradation. Specific gravity shall be 2.7 or higher. A certified material test report shall be provided. This coarse aggregate will be	**1. Vulcan Materials Company** Maryville Quarry 2201 Duncan Road Maryville, TN 37803 Phone: 865-983-0163 Fax: 865-983-1508 Contact: Jim Mays (sales) 865-577-2511	Excellent limestone with a App. Specific gravity of 2.8 and SSD = 2.82. They supply aggregate sizes No.467, 1 ½", or No. 67, ¾".

Constituent	Description/Requirements	Supplier	Notes
	tested for full conformance to ASTM C 33.	**2. Vulcan Materials Company** Norcross Quarry 1707 Beaver Ruin Road Norcross, GA 30093 Phone: 770-923-2532 Kennesaw Quarry 1272 Duncan Road Kennesaw, GA 30144 Phone: 770-427-2401 Contacts: Mr. Stewart Malley - QC 404-386-3911 Bill Ottaway –Norcross Sales 770-454-3655 Shannon Wehunt – Kennesaw Sales 770-454-3646	Crushed granite from either of the two sources near Atlanta GA. Contact indicated specific gravity vales from 2.72 in one plant to 2.74 in the other. Ready mix plants using this aggregate obtain 8000 psi at 28 days.
Sand	ASTM C33 fine aggregate for concrete with a FM of 2.7 to 3.1. A certified material test report shall be provided. This fine aggregate will be tested for conformance to ASTM C 33.	**1. Vulcan Materials Company** Maryville Quarry 2201 Duncan Road Maryville, TN 37803 Phone: 865-983-0163 Fax: 865-983-1508 Contact: Jim Mays (sales) 865-577-2511	Fineness Modulus (FM) for this sand may exceed the ASTM C33 limit of 3.1 up to a value of 3.3.
		2. B. V. Hedrick Gravel & Sand Lilesville Quarry Lilesville, NC Contact: Peggy Jones 7843-672-3477 x1	This is mainly a natural silica sand with an addition of crushed granite to raise the FM to 2.80. Clay content was confirmed to be less than 3%.

Constituent	Description/Requirements	Supplier	Notes
Fly ash	Fly ash will be sampled and tested for conformance to ASTM C 618 including the Supplementary Optional Physical requirements for the following: a. Multiple factor. b. Effectiveness in controlling Alkali-silica reaction if aggregates are reactive the alkalies in cement. A certified material test report shall be provided.	**ProAsh, Separation Technologies** Contact: Tiffany Duffy Separation Technologies LLC – ProAsh Florida Sales Representative Cell: (813)-846-2732 Fax: (813)-741-1876 Email: tduffy@proash.com	Processed fly ash is more expensive but it has being selected and processed to eliminate unburned coal and coarse particles. Since the weight of fly ash will be in the order of 20% of the weight of cement the use of processed fly ash may be a good option, however price, quality and availability of fly ash in Florida should be considered. Class C fly ash is preferred, but we can use Class F as well.
Silica Fume	RHEOMAC SF 100	**Master Builders** Tel: 800-628-9990	Silica fume is produced by Norchem's Silica Fume, and marketed by the three listed companies. The selection depends on location, of distributors and of price, since it is the same product.
	Sikacrete 950DP	**SIKA** Tel: 201-933-8800	
	Target DSF	**Target Products Ltd.** Contact by email http://www.targetproducts.com/facilities/facilities.htm	
	For any of the above, certified test reports for conformance to ASTM C 1240 shall be provided.		
Water Reducing Admixture	UCON WR 91 Certified test reports for conformance to ASTM C 494 shall be provided.	**The Euclid Chemical Company** 19218 Redwood Road Cleveland, OH 44110 Tel: 800-321-7628 Contact: Ron Foster 239-633-0437	Only one source of admixtures will be selected for the project.
High range water reducing admixture (superplasticizer)	Plastol 100 Certified test reports for conformance to ASTM C 494 shall be provided.		

ATTACHMENT 2
Sheet 1 of 1
Record of Lead Review

Document ER-1, ER-2, ER-3, ER-4, ER-5 Sheet 1 and 2 **Revision 0**

The signature below of the Lead Reviewer records that:
- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☒ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

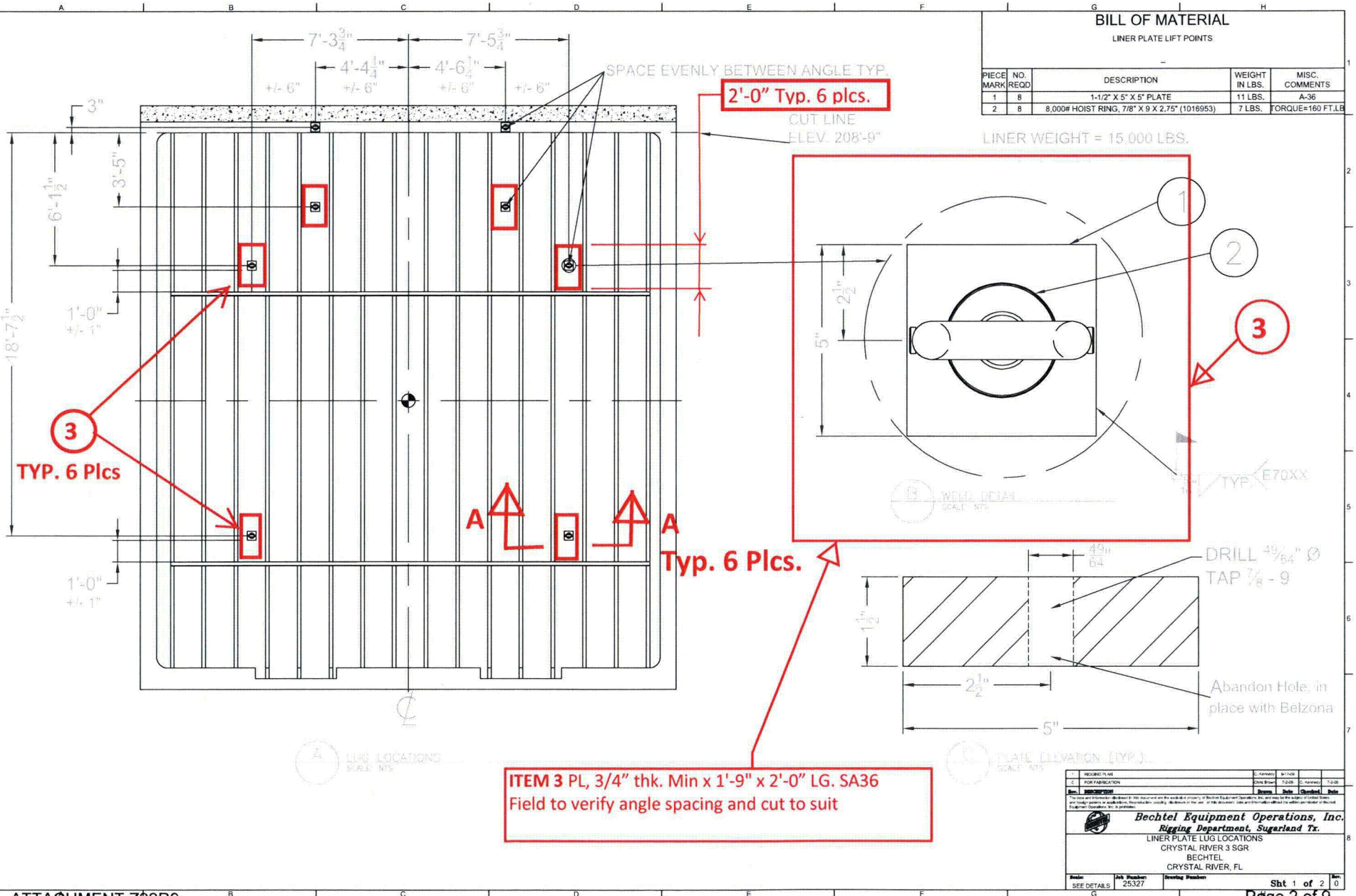
☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday	John Holliday	Civil	9/3/08
Lead Reviewer	**(print/sign)**	**Discipline**	**Date**

Item No.	Deficiency	Resolution
	None	

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.



ITEM 3 PL, 3/4" thk. Min x 1'-9" x 2'-0" LG. SA36
Field to verify angle spacing and cut to suit

BILL OF MATERIAL

LINER PLATE LIFT POINTS

PIECE MARK	NO. REQD	DESCRIPTION	WEIGHT IN LBS.	MISC. COMMENTS
1	8	1-1/2" X 5" X 5" PLATE	11 LBS.	A-36
2	8	8,000# HOIST RING, 7/8" X 9 X 2.75" (1016953)	7 LBS.	TORQUE=160 FT.LB

Rev.	DESCRIPTION	Drawn	Date	Checked	Date
C	RIGGING PLAN	C. Kennedy	6-17-08		
D	FOR FABRICATION	Chris Brown	7-2-08	C. Kennedy	7-2-08

Bechtel Equipment Operations, Inc.
Rigging Department, Sugarland Tx.

LINER PLATE LUG LOCATIONS
CRYSTAL RIVER 3 SGR
BECHTEL
CRYSTAL RIVER, FL

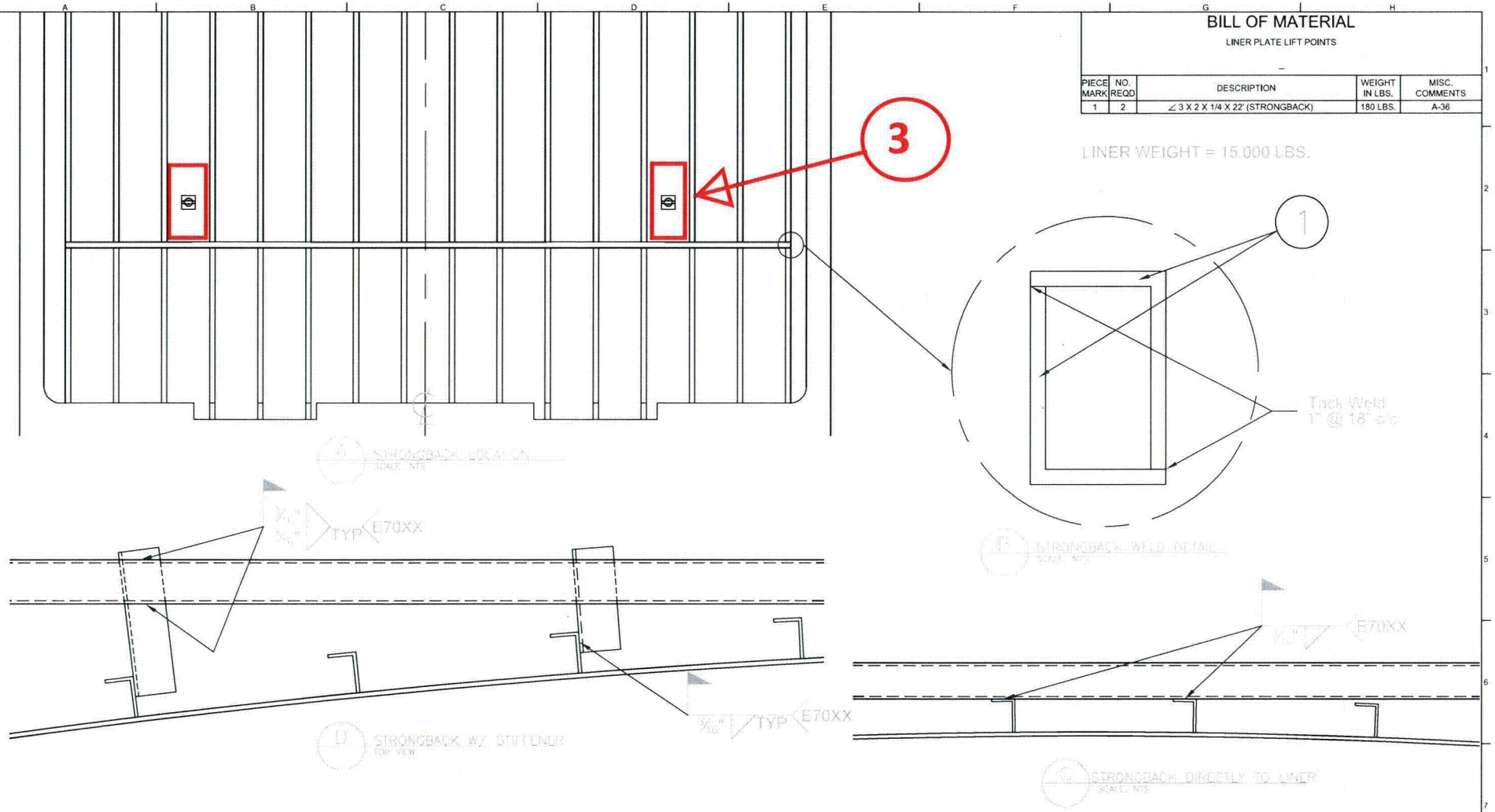
Scale	Job Number	Drawing Number	Sht 1 of 2	Rev.
SEE DETAILS	25327			0

BILL OF MATERIAL

LINER PLATE LIFT POINTS

PIECE MARK	NO. REQD	DESCRIPTION	WEIGHT IN LBS.	MISC. COMMENTS
1	2	∠ 3 X 2 X 1/4 X 22' (STRONGBACK)	180 LBS.	A-36

LINER WEIGHT = 15,000 LBS.



Notes:

1. CARBON STEEL (CS) PLATE MAY BE USED TO BRIDGE GAP BETWEEN THE STIFFENER AND EXISTING ANGLE.
2. 3x2x1/4 CS ANGLE MAY BE TEMPORARILY TACK WELDED TO EXISTING ANGLE AS REQUIRED TO PROVIDE SUPPORT TO LINER WHILE RIGGING

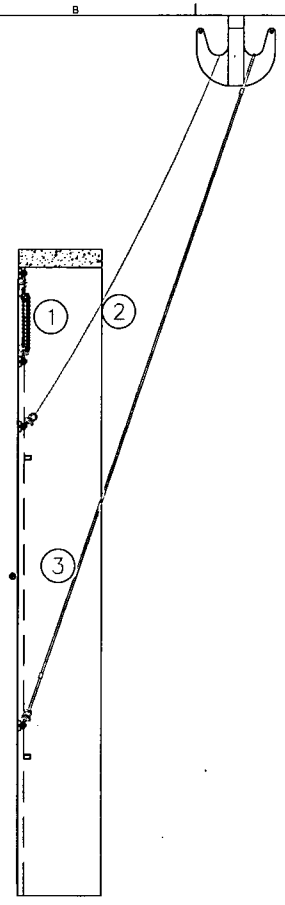
Rev.	DESCRIPTION	Drawn	Date	Checked	Date
1	RIGGING PLAN	C. Kennedy	5-11-09		
2	FOR FABRICATION	Chris Brown	7-2-09	C. Kennedy	7-2-09

Bechtel Equipment Operations, Inc.
Rigging Department, Sugarland Tx.

LINER PLATE STONGBACK DETAIL
CRYSTAL RIVER 3 SGR
BECHTEL
CRYSTAL RIVER, FL

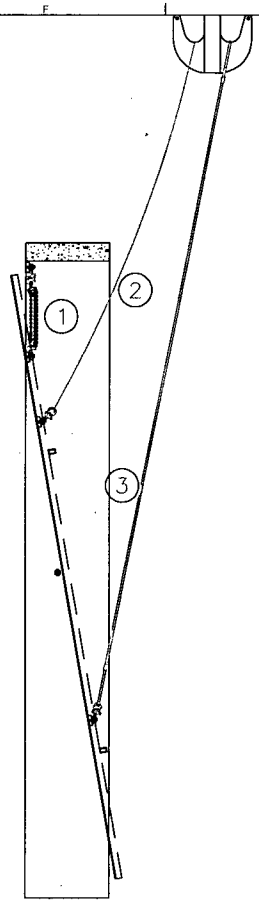
Scale:	Job Number:	Drawing Number:	Sht 2 of 2	Rev.
SEE DETAILS	25327			1

1. 5 Ton Chain Fall (2)
2. SP 1400 Slings (2)
3. SP 1400 Slings (2)
6 ½ ton Shackle (8)



1. TAUT
2. LOOSE
3. LOOSE

POSITION 1.
LINER PLATE TO BE CUT



1. TAUT
2. LOOSE
3. TAUT

POSITION 2.
LINER PLATE CUT LOOSE

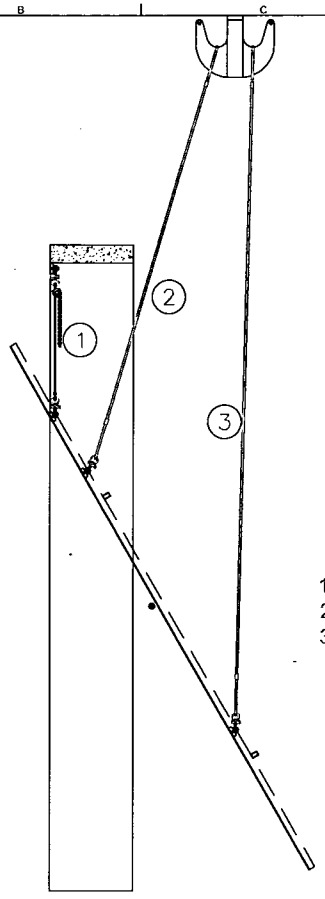
1	REDLINE PLAN	C. Kennedy	8-19-08	
0	FOR FABRICATION	Chris Brown	7-2-08	C. Kennedy 7-2-08
Rev.	DESCRIPTION	Drawing	Date	Checked Date

Bechtel Equipment Operations, Inc.
Rigging Department, Sugarland Tx.

LINER PLATE LUG LOCATIONS
CRYSTAL RIVER 3 SGR
BECHTEL
CRYSTAL RIVER, FL

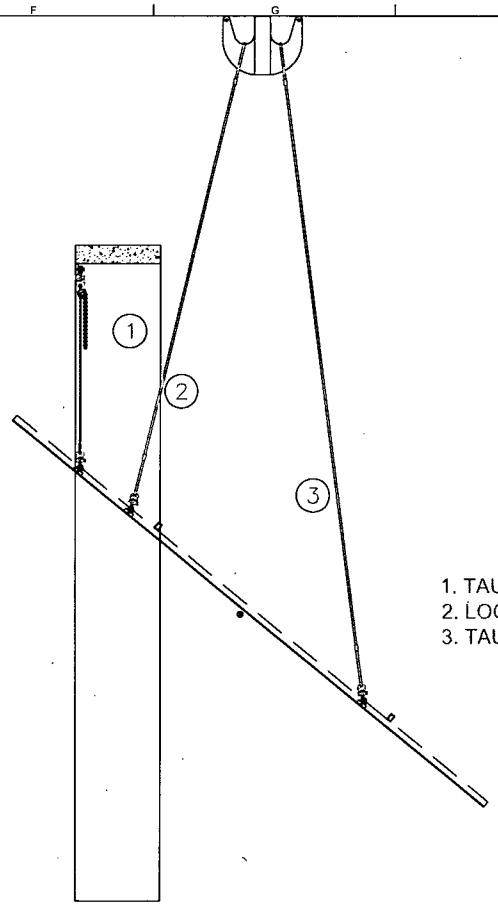
Scale	Job Number	Drawing Number	Sht	Rev.
SEE DETAILS	25327		Sht 1 of 3	1

1. 5 Ton Chain Fall (2)
2. SP 1400 Slings (2)
3. SP 1400 Slings (2)
6 ½ ton Shackle (8)



1. TAUT, HALF LOAD
2. LOOSE
3. TAUT, HALF LOAD

POSITION 3.
CRANE HOOK RAISED



1. TAUT
2. LOOSE
3. TAUT

POSITION 4.
LEG 1 AND CRANE HOOK LOWERED

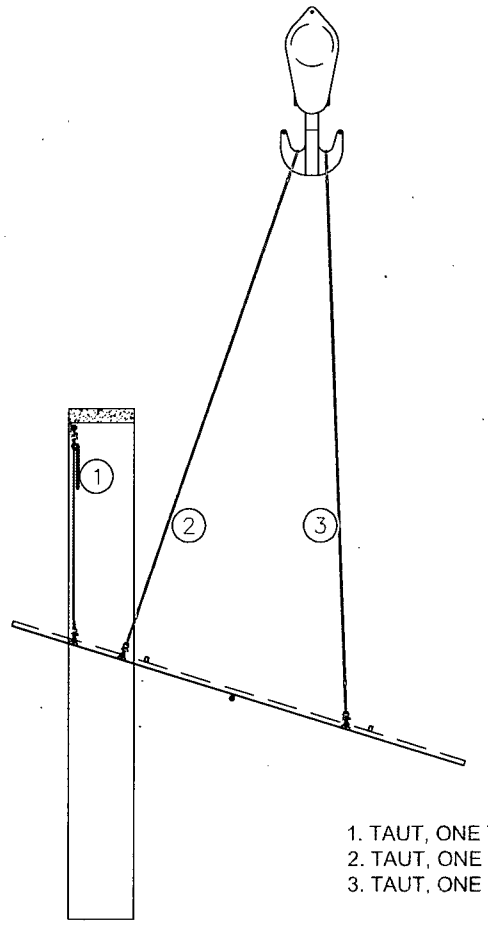
1	REDRAFT PLAN	C. Kennedy	6-13-08	
0	FOR FABRICATION	Chris Brown	7-2-08	C. Kennedy 7-2-08
Rev.	DESCRIPTION	Drawing	Date	Checked Date

Bechtel Equipment Operations, Inc.
Rigging Department, Sugarland Tx.

LINER PLATE LUG LOCATIONS
CRYSTAL RIVER 3 SGR
BECHTEL
CRYSTAL RIVER, FL

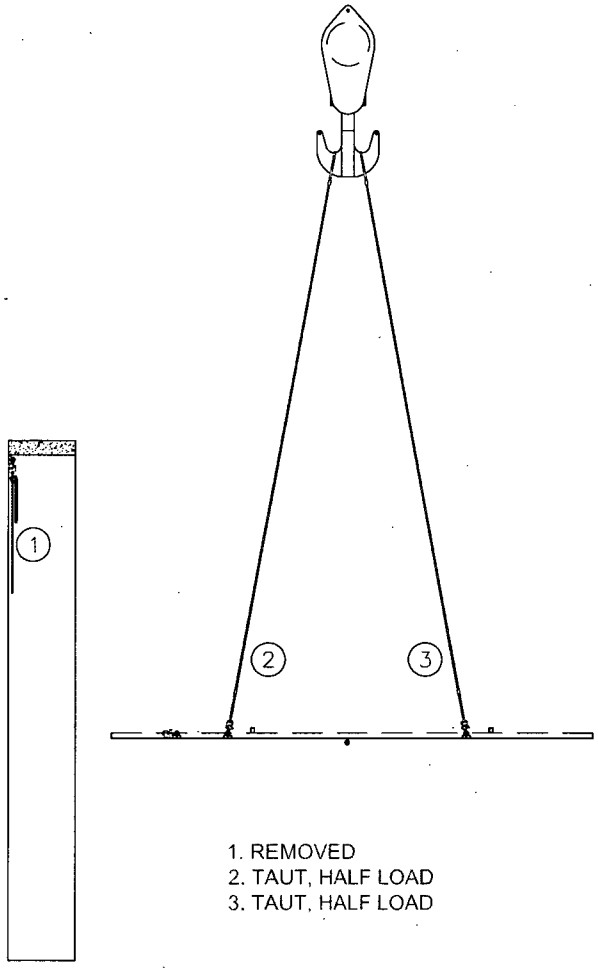
Scale	Job Number	Drawing Number	Sht	Rev.
SEE DETAILS	25327		2 of 3	1

1. 5 Ton Chain Fall (2)
2. SP 1400 Slings (2)
3. SP 1400 Slings (2)
6 ½ ton Shackle (8)



1. TAUT, ONE THIRD LOAD
2. TAUT, ONE THIRD LOAD
3. TAUT, ONE THIRD LOAD

POSITION 5.
LEG 1 LOWERED UNTIL
CRANE HAS LOAD WITH
LEG 2 AND 3



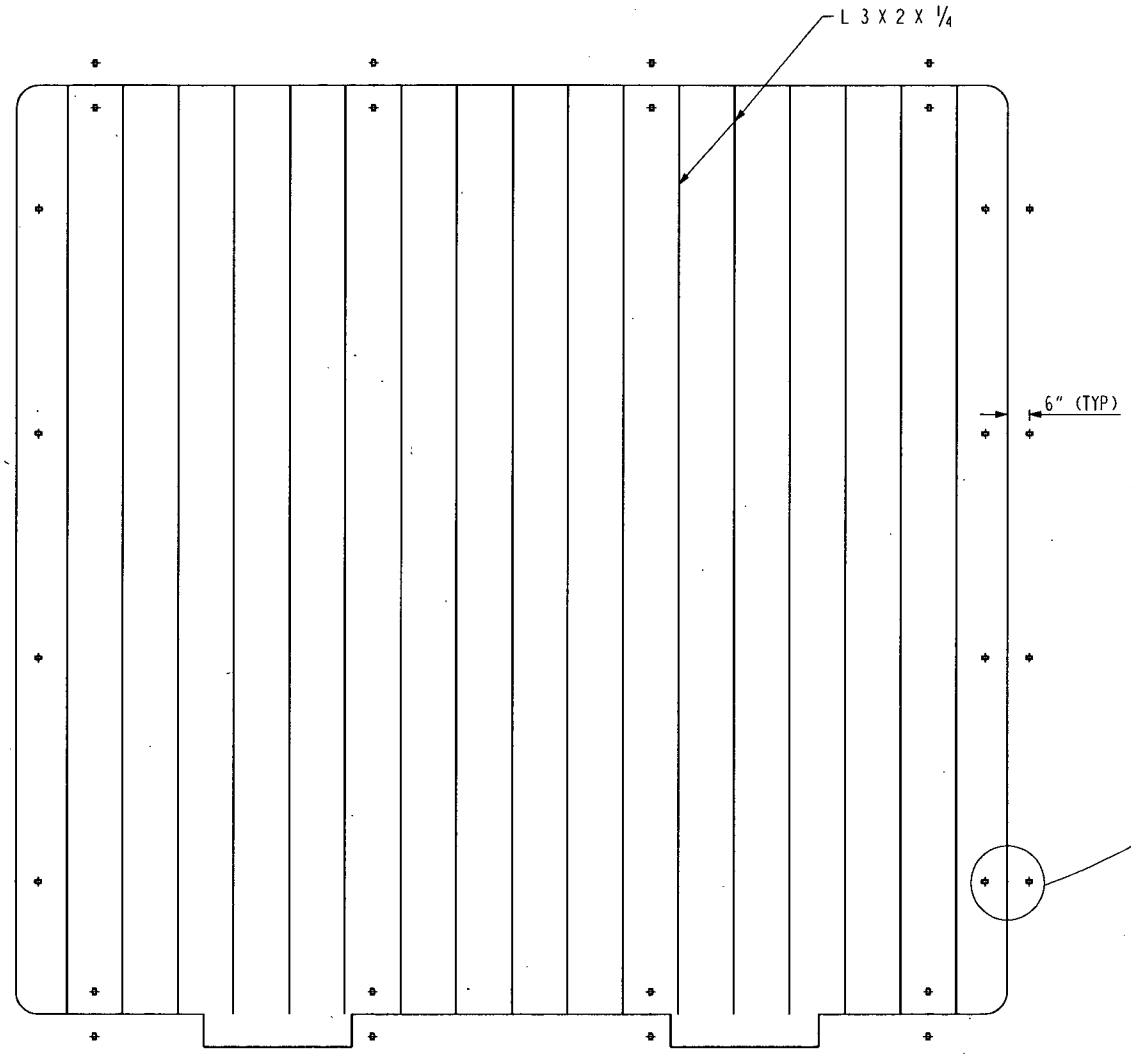
1. REMOVED
2. TAUT, HALF LOAD
3. TAUT, HALF LOAD

POSITION 6.
LEG 1 CUT LOOSE, CRANE HAS LOAD

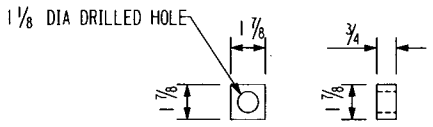
1	RIGGING PLAN	C. Kennedy	9-19-08	
0	FOR FABRICATION	Chris Brown	7-2-08	C. Kennedy 7-2-08
Rev.	DESCRIPTION	Drawn	Date	Checked Date

Bechtel Equipment Operations, Inc.
Rigging Department, Sugarland Tx.
LINER PLATE LUG LOCATIONS
CRYSTAL RIVER 3 SGR
BECHTEL
CRYSTAL RIVER, FL

Scale: SEE DETAILS	Job Number: 25327	Drawing Number:	Sht 3 of 3 Rev. 1

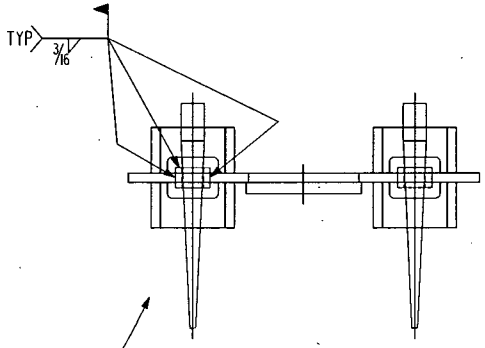


VIEW FROM OUTSIDE



BLANK NUT DETAILS (A36)

NOT TO SCALE



STANDARD TEMPORARY SUPPORT

NOT TO SCALE

NOTES :

1. WELDING TO BE WITH A APPROVED WELDING PROCEDURE.
2. FIT-UP GEAR AS REQUIRED.
3. FIELD LOCATE AS NEEDED.
4. FIELD PERSONEL TO RECORD AS-BUILT.

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE M53BERD050I.DGN

CBI
CORPORATE CONSTRUCTION TECHNOLOGY

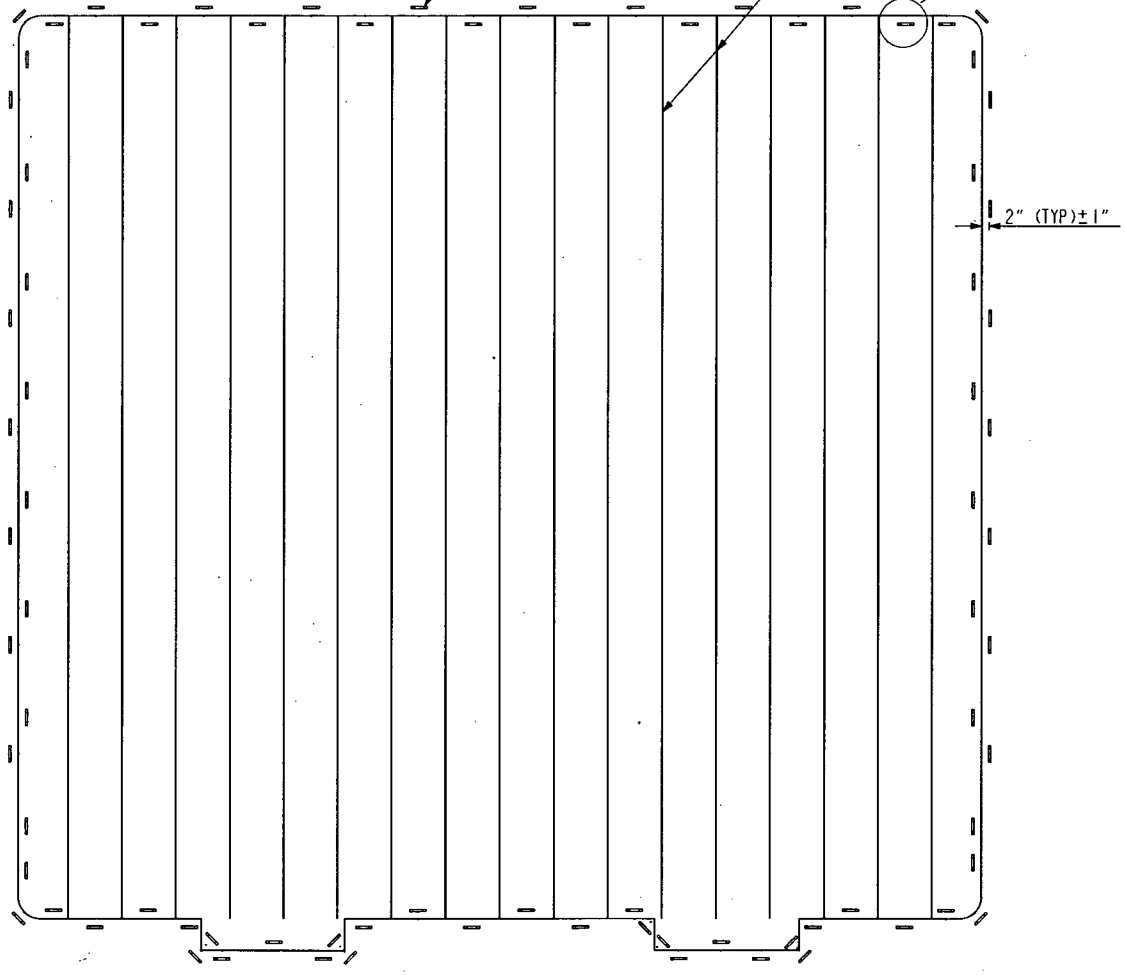
SUPPLIER'S / PURCHASER'S NO

FIT-UP MATERIALS ON DOOR SHEET
PROGRESS ENERGY FLORIDA INC
CRYSTAL RIVER UNIT #3
CRYSTAL RIVER, FLORIDA

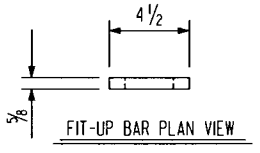
CUSTOMER'S NO
BY JRK CHKD JRK DATE 07-24-08
J.R.KUCIC/CCT
ENGINEERING SUPERVISOR

CONTRACT NO 40-145318
DWG ER-5 REV 0
SHT 1

REVISIONS REMARKS

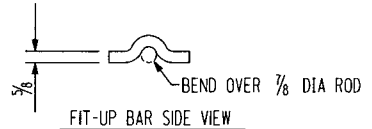


VIEW FROM OUTSIDE



FIT-UP BAR PLAN VIEW

NOT TO SCALE



FIT-UP BAR SIDE VIEW

NOT TO SCALE

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CBI
CORPORATE CONSTRUCTION TECHNOLOGY

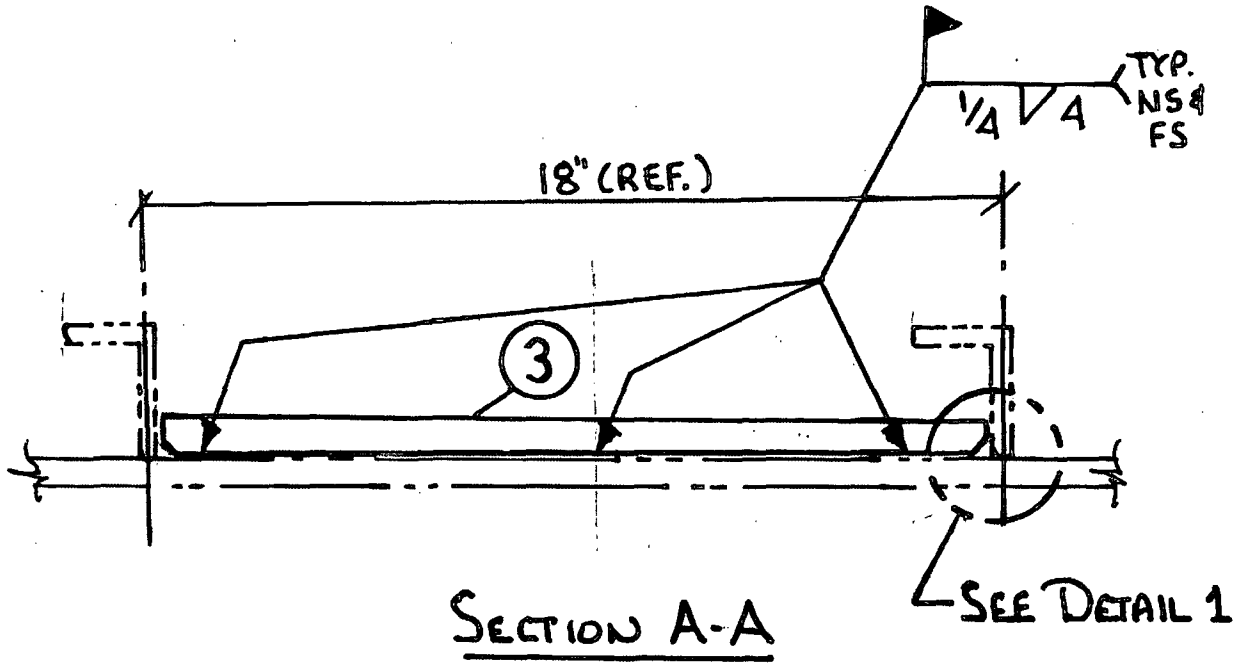
SUPPLIER'S / PURCHASER'S NO

FIT-UP MATERIALS ON DOOR SHEET
PROGRESS ENERGY FLORIDA INC
CRYSTAL RIVER UNIT #3
CRYSTAL RIVER, FLORIDA

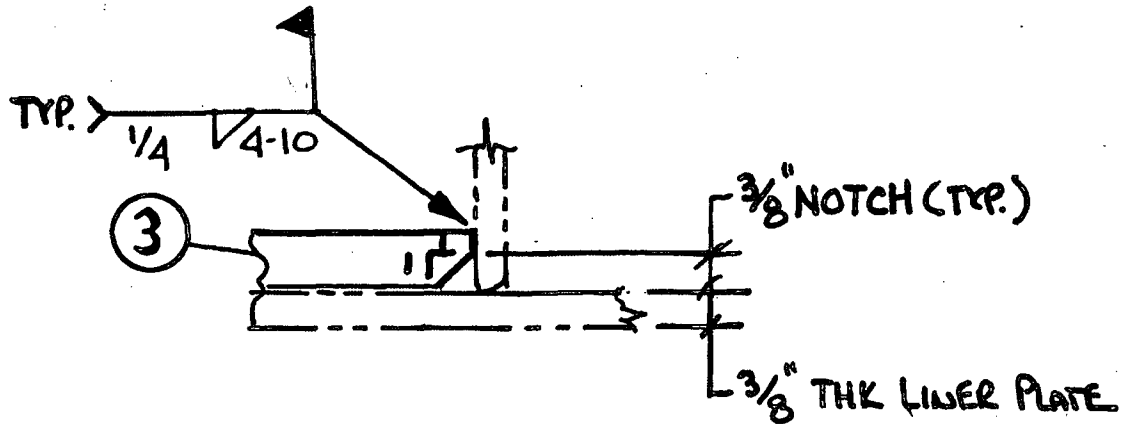
CUSTOMER'S NO
BY JRK CHKD JRK DATE 07-24-08
J.R.KUCIC/CCT
ENGINEERING SUPERVISOR

CONTRACT NO 40-145318
DWG ER-5 REV 0
SHT 2

REMARKS
REVISIONS
BY CHKD DATE



SECTION A-A



DETAIL 1

Record of Lead Review

Document CBI drawings 2A18-9 and 2A20-4 Revision 9 and 4 as shown in drawing number

The signature below of the Lead Reviewer records that:
- the review indicated below has been performed by the Lead Reviewer;
- appropriate reviews were performed and errors/deficiencies (for all reviews performed) have been resolved and these records are included in the design package;
- the review was performed in accordance with EGR-NGGC-0003.

☐ **Design Verification Review** ☒ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

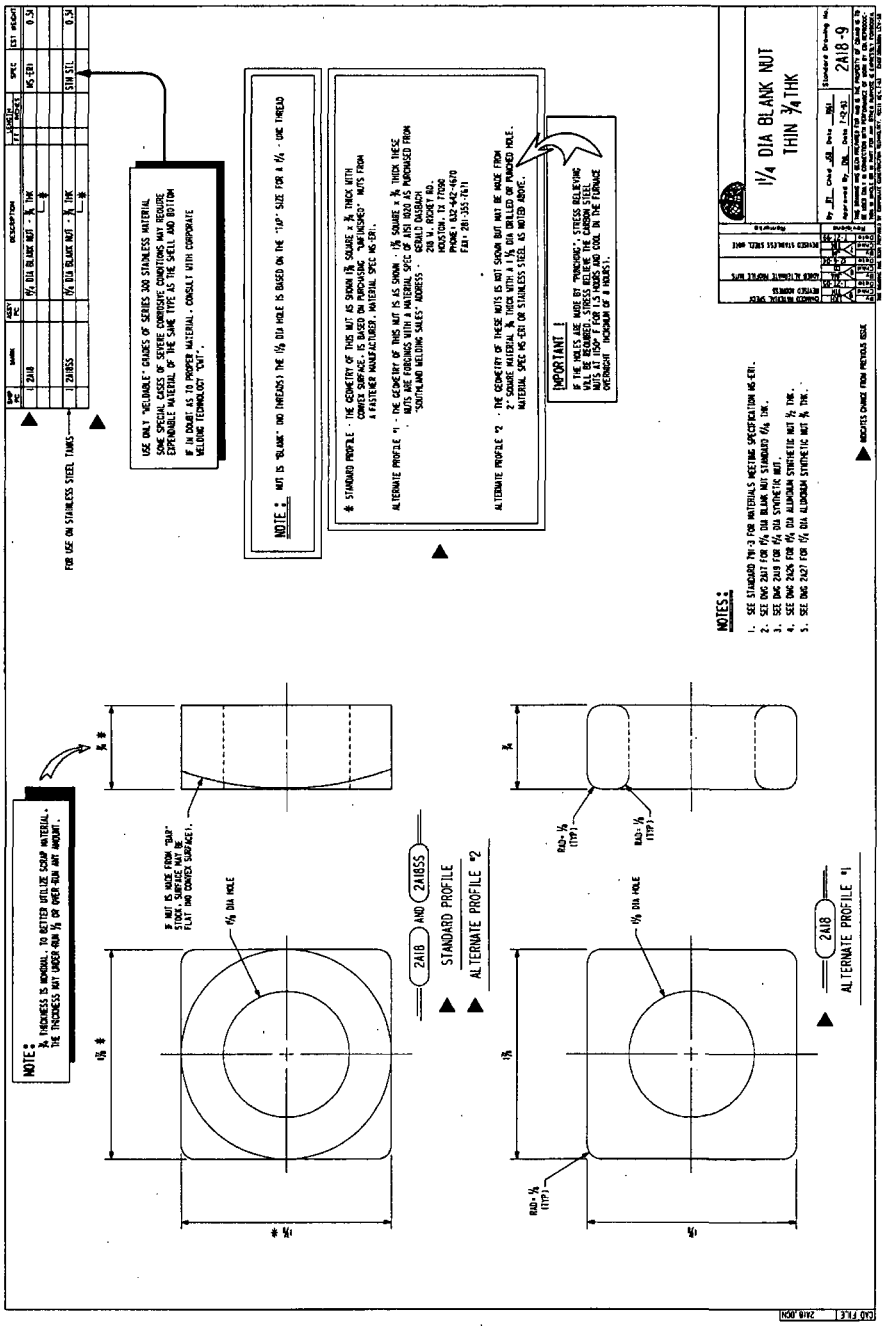
☐ **Special Engineering Review**_____

☐ YES ☐ N/A **Other Records are attached.**

John Holliday	John Holliday	Civil	9/3/08
Lead Reviewer	**(print/sign)**	**Discipline**	**Date**

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-2-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.


1¼ DIA BLANK NUT
THIN ¾ THK
2A18-9
NOTES:
1. SEE STANDARD TM-3 FOR MATERIALS MEETING SPECIFICATION MS-KEY.
2. SEE DWG 2A17 FOR ⅝ DIA BLANK NUT STANDARD ⅝ THK.
3. SEE DWG 2A19 FOR ⅝ DIA SYNTHETIC NUT.
4. SEE DWG 2A26 FOR ⅝ DIA ALUMINUM SYNTHETIC NUT ½ THK.
5. SEE DWG 2A27 FOR ⅝ DIA ALUMINUM SYNTHETIC NUT ¾ THK.
IMPORTANT !
NOTE:
2A18 AND 2A18SS
STANDARD PROFILE
ALTERNATE PROFILE #2
2A18
ALTERNATE PROFILE #1