DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Office of Structural Materials
Quality Assurance and Source Inspection

Bay Area Branch
690 Walnut Ave.St. 150
Vallejo, CA 94592-1133
(707) 649-5453
(707) 649-5493

Contract #: 04-0120F4
Cty: SF/ALA Rte: 80 PM: 13.2/13.9
File #: 1x.25B

QUALITY ASSURANCE -- NON-CONFORMANCE REPORT

Location: W2 Cap Beam, SFOBB **Report No:** NCR-000186
Prime Contractor: American Bridge/Fluor Enterprises, a JV **Date:** 27-Aug-2008
Submitting Contractor: American Bridge/Fluor Enterprises, a JV **NCR #:** ABF-0004

Type of problem:

Welding	☐	**Concrete**	☑	**Other**	☐	
Welding	☐	**Curing**	☐	**Procedural**	☐	**Bridge No:** 34-0006
Joint fit-up	☐	**Coating**	☐	**Other**	☐	**Component:** W2 Cap Beam, #43 HRC Couplers
Procedural	☐	**Procedural**	☑	**Descripton:**		

Reference Description: Headed coupler fabrication operators did not follow specifications for #43 Couplers for W2 Cap Beam Pour 3, top mat

Description of Non-Conformance:

For the W2 Cap Beam, Pour 3, top mat, the Contractor fabricated non-conforming male coupler heads for #43 transverse rebar HRC couplers at the job site, which were then tested as completed work. Each of four Quality Assurance (QA) samples failed QA testing for slip: the smallest margin of failure was 60%; the largest, approximately 300%. Evaluation of the samples found defective workmanship, including ridges not ground and improperly formed "mushroom" heads; please see picture. The Contractor has stated that a large proportion of male heads are believed to have ridges not properly ground. ABF-RFI-1494 states that because of these problems, the work is incomplete, and requests re-sampling and re-testing.

Applicable reference:

Caltrans Standard Specifications (CSS), 1999, Section 52-1.08C, "Mechanical Butt Splices," p. 392, para. 1: "Splicing procedures shall be in conformance with the manufacturer's recommendations..."

CSS, 1999, Section 5-1.08, p. 25, para. 2: "The inspection of material shall not relieve the Contractor...the work

QUALITY ASSURANCE -- NON-CONFORMANCE REPORT

(Continued Page 2 of 2)

or materials have been previously inspected by the Engineer..."

Who discovered the problem: Trans Lab

Name of individual from Contractor notified: Jim Davidson

Time and method of notification: 1600 Wednesday, August 27, 2008; face-to-face meeting

Name of Caltrans Engineer notified: Gil Klebanov

Time and method of notification: 1400 Wednesday, August 27, 2008; face-to-face meeting

QC Inspector's Name: Unknown

Was QC Inspector aware of the problem: ☐ **Yes** ☑ **No**

Contractor's proposal to correct the problem:

Re-work coupler heads to bring them into conformance. METS understands that the Engineer will revoke relevant fabrication operator qualifications and work will proceed per METS response to ABF-RFI-1494, as previously agreed:

1. The Contractor shall disassemble all coupler heads and inspect, repair, and if necessary re-work all noncompliant heads.
2. The Contractor shall complete work with qualified and/or re-qualified operators.
3. The Contractor shall submit all standards for QC and QA sampling and testing in conformance with the contract requirements to inspect completed heads, including the relevant dimensions and drawings.
4. Couplers shall then be re-installed upon acceptance of re-worked heads and clearing of the to-be-issued Non-Conformance Reports (NCR).
5. Re-work is considered submission of new work to the Department, and will require both QA and QC testing.
6. Should either of the QC or QA tests fail, the Contractor shall remove and discard all the heads and re-do the work.
7. Written authorization from HRC is required to re-use the currently installed couplers. If such authorization is received, all coupler components shall be inspected by the Contractor for damage such as, but not limited to, gouges, bending, dents, etc.
8. Couplers may only be re-installed upon acceptance of the reworked heads and clearing of all NCRs.

Comments:

This report is for the purpose of determining conformance with the contract documents and is not for the purpose of making repair or fit for purpose recommendations. Should you require recommendations concerning repairs or remedial efforts please contact Venkatesh Iyer, (858) 967-6363, who represents the Office of Structural Materials for your project.

Inspected By:	Petrina,Markian	SMR
Reviewed By:	Iyer,Venkatesh	SMR

DEPARTMENT OF TRANSPORTATION

333 Burma Road Working Drawing Campus

Oakland CA 94607

Tel: 510-808-4611 Fax:

NON-CONFORMANCE REPORT TRANSMITTAL

To:	AMERICAN BRIDGE/FLUOR, A JV	**Date:**	22-Sep-2008
	375 BURMA ROAD		
	OAKLAND CA 95607	**Contract No:**	04-0120F4
Dear:	Mr. Charles Kanapicki		04-SF-80-13.2 / 13.9
Attention:	Mr. Jim Davidson	**Job Name:**	SAS Superstructure
Subject:	NCR No. ABF-0004	**Document No:**	05.03.06-000167

Reference Description: Headed coupler fabrication operators did not follow specifications for #43 Couplers for W2 Cap Beam Pour 3, top mat

The Attached Non-Conformance Report describes an occurrence where the contractor did not comply with a requirement of the contract document as indicated below:

- [x] Material or Workmanship not in conformance with contract documents.
- [x] Quality Control (QC) not performed in conformance with contract documents.
- [ ] Recurring QC issue that constitutes a systematic problem in quality control.
- [ ] Non-Conformance Resolved.

Remarks:

Material Location: Other **Lift:**

For the W2 Cap Beam, Pour 3, top mat, the Contractor fabricated non-conforming male coupler heads for #43 transverse rebar HRC couplers at the job site, which were then tested as completed work. All four Quality Assurance (QA) samples failed QA testing for slip. Evaluation of the samples found poor workmanship, including ridges not ground and improperly formed "mushroom" heads.

Action Required and/or Action Taken:

Propose a resolution for the identified non-conformance with revised procedures to prevent future occurrences.

Transmitted By: Ron Matin Transportation Engineer

Attachments: ABF-0004

cc:

File: 05.03.06

AMERICAN BRIDGE/FLUOR ENTERPRISES, a JV
P.O. BOX 23223 Oakland, CA 94623
Phone (510) 419-0120 / Fax (510) 839-0666

NCR PROPOSED RESOLUTION

To: CALTRANS - SAS Superstructure
333 Burma Road
Oakland CA 94607

Attention: Pursell, Gary
Resident Engineer

Ref: 05.03.06-000167

Subject: NCR No. ABF-0004

Dated: **03-Oct-2008**
Contract No.: 04-0120F4
04-SF-80-13.2 / 13.9
Job Name: SAS Superstructure
Document No.: **ABF-NPR-000166 Rev: 00**

Contractor's Proposed Resolution:

Reference Resolution: Required rework and retesting successfully completed

Regarding the Department's eight items of concern ABFJV offers the following:
1. Item #1 of the Department's NCR states "The Contractor shall disassemble all coupler heads." Couplers had not been assembled only headed, as such ABFJV and CMC-Regional Steel inspected for gouges, bending and dents, etc. CMC-Regional Steel then repaired and reworked the noncompliant heads the week of September 22, 2008 under the Department's, ABFJV's and CMC-Regional's oversight and supervision.
2. The heads were reworked through grinding operations, reforming the heads through the application of heat and forming tool was not performed. The last field heading operation was performed on bars cut for QA and QC test samples by Gilbert Gallegos, the operator CMC-Regional Steel uses in their Tracy, CA shop. Mr. Gallegos' training certificate is attached.
3. Attached is the Xtender Operating Manual containing manufacturer's guidelines and recommended practices for using the Xtender system that was included in revision 13 to the Mechanical Splice Prequalification Report submitted to the Department October 2, 2008.
4. CMC-Regional Steel has qualified additional connecting operators. Attached are the operator qualifications test reports for Jose Cervantes and Salvador Ramon that were included in revision 13 to the Mechanical Splice Prequalification Report submitted to the Department October 2, 2008. Work will be completed by these additional operators.
5. A total of twelve samples were taken from the completed work, four for QA testing and eight for QC testing. Passing QC test results were included in revision 13 to the Mechanical Splice Prequalification Report submitted to the Department October 2, 2008 and are attached to this NPR.
6. QC tests passed and it is our understanding that QA samples tested passed as well.
7. As stated in item #1, couplers were never put together, only bar ends were headed. Heads were inspected and repairs performed in accordance with the Xtender Operating Manual noted in item #3 above. As such we are not in a position to request written authorization for reuse from HRC. If the Department wishes we can ask HRC to provide something appropriate for the work performed.

Based on the above ABFJV respectfully requests that the NCR be closed allowing installation operations to recommence.

Submitted by: Kanapicki, Charles

Attachment(s): ABF-NPR-000166R00; ;

Caltrans' comments:

Status: CLO

Date: 16-Oct-2008

The Contractor's resolution is satisfactory. The Contractor may proceed with splicing of the pertinent bars.

Submitted by: Matin, Ron

Date: 16-Oct-2008

Attachment(s):

Training Certificate

Presented to:

GILBERT GALLEGOS

Has successfully completed a training course for:

XTENDER SPLICING SYSTEM

at:

HEADED REINFORCEMENT CORPORATION

Presented this: 25TH *Day of:* JUNE, 2001

Signature

Signature

In accordance with CalTrans Standard Specification sections 52-1.08C and 52-1.08C(1) as modified by the Special Provisions, American Bridge / Fluor Enterprises, Inc. a Joint Venture (ABFJV) has prepared Revision 13 to the previously submitted Splice Prequalification Report (ABF-SUB-000293R0).

This revision includes:

- The updated Rebar Coupler ID Log showing couplers ABFJV 55 a to d to 56 a to d that are operator test results for Jose Cervantes and Salvador Ramon on 43 bars with HRC 500/510 couplers. These couplers test samples were obtained in the field from the W2 Cap Beam as part of the rework/repair effort for the previously failed pour 3 couplers that were field headed.
- The Xtender Operating Manual containing manufacturer's guidelines and recommended practices for using the Xtender system.

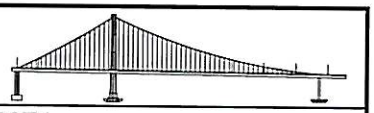
NOTE: The data highlighted in yellow on the attached Rebar Coupler ID Log are provided for information purposes only, not for approval as revisions to the original Splice Prequalification Report.

The undersigned has reviewed and approved this Splice Prequalification Report:

Name _____ Date 10/2/08

American Bridge / FLUOR. A JOINT VENTURE

Rebar Coupler ID Log

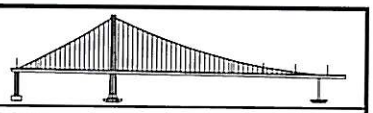


Project: SFOBB Self-Anchored Suspension Bridge | **Contract No.: 04-0120F4**

ID No	Date	Pre-Job	Operator (Name)	Prod Lot	Coupler	Bar (mm)	Position (Horiz / Vert)	Couple Ht	Rebar Ht	Pass / Fail	Comment
1a,b	8/10/07		Jason Jobe		500/510	43	H	C64819/794011	Tamco 71031	P	
2a,b	8/10/07		Michael Esquer		500/510	43	H	C64819/794011	Tamco 71031	F	
3a,b	8/10/07		Brice Mauser		500/510	43	H	C64819/794011	Tamco 71031	P	
4a-d	8/10/07	X	Steve Dennison & Russ Voss		500/510	43	H	C64819/794011	Tamco 71031	F	
5a,b	8/23/07	X	Brice Mauser		500/551	43	V	C64819/7740786	Tamco 71031	P	
6a,b	8/23/07	X	Michael Esquer		500/551	43	V	C64819/7740786	Tamco 71031	P	
7a,b	8/23/07		Joe Bell		500/551	43	V	C64819/7740786	Tamco 71031	P	
8a,b	8/30/07	X	Bob Thomas		500/510	43	H	C64819/794011	Tamco 71031	P	Re-run of 4a-d
8c,d	8/30/07	X	Danny Celaya		500/510	43	H	C64819/794011	Tamco 71031	P	Re-run of 4a-d
9a,b	8/30/07		Michael Esquer		500/510	43	H	C64819/794011	Tamco 71031	P	Re-run of 2a,b
10a,b	8/30/07		Michael Esquer		500/510	19	H	691030/691030	Tamco 72096	P	
11a,b	8/30/07		Brice Mauser		500/510	19	H	691030/691030	Tamco 72096	P	
12a,b	8/30/07	X	Danny Celaya		500/510	19	H	691030/691030	Tamco 72096	P	
12c,d	8/30/07	X	Bob Thomas		500/510	19	H	691030/691030	Tamco 72096	P	
13a-d	9/13/07	X	Brice Mauser		500/520	19	H	691030/1606440	Tamco 72406	P	
14a,b	9/13/07		Brice Mauser		500/520	19	H	691030/1606440	Tamco 72406	P	

American Bridge / FLUOR. A JOINT VENTURE

Rebar Coupler ID Log

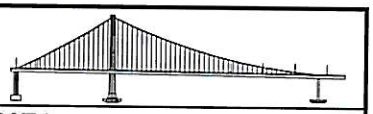


Project: SFOBB Self-Anchored Suspension Bridge | **Contract No.: 04-0120F4**

ID No	Date	Pre-Job	Operator (Name)	Prod Lot	Coupler	Bar (mm)	Position (Horiz / Vert)	Couple Ht	Rebar Ht	Pass / Fail	Comment
15a-d	9/24/07		Brice Mauser	37	500/510	43	H	C64819/794011	Tamco 71058	P	
16a-d	10/18/07		Brice Mauser	A	500/510	43	H	8991323/794011	Tamco 71065	P	
17a-d	10/18/07		Brice Mauser	B	500/510	43	H	8991323/794011	Tamco 71055	P	
18a-d	10/18/07		Brice Mauser	C	500/510	43	H	8991323/794011	Tamco 71053	F	RFI1019
19a-d	10/18/07		Brice Mauser	D	500/510	43	H	8991323/794011	Tamco 72638	P	
20a-d	10/18/07		Brice Mauser	E	500/510	43	H	8991323/794011	Tamco 71055	P	
21a,b	11/21/07		Lance Gaige		500/510	19	H	691030/781465	Tamco 72096	P	
22a,b	11/21/07		Tim Greenlee		500/510	19	H	691030/781465	Tamco 72096	P	
23a,b	11/21/07		Jorge Lopez		500/510	19	H	691030/781465	Tamco 72096	P	
24a,b	11/21/07		Jon Van Brusselen		500/510	19	H	691030/781465	Tamco 72096	P	
25a,b	11/21/07		Lance Gaige		500/510	25	H	691030/691030	Tamco 71649	P	
26a,b	11/21/07		Tim Greenlee		500/510	25	H	691030/691030	Tamco 71649	P	
27a,b	11/21/07		Jorge Lopez		500/510	25	H	691030/691030	Tamco 71649	P	
28a,b	11/21/07		Jon Van Brusselen		500/510	25	H	691030/691030	Tamco 71649	P	
29a,b	11/21/07		Lance Gaige		500/510	43	H	8991323/794011	Tamco 71031	P	
30a,b	11/21/07		Tim Greenlee		500/510	43	H	8991323/794011	Tamco 71031	P	

American Bridge / FLUOR. A JOINT VENTURE

Rebar Coupler ID Log

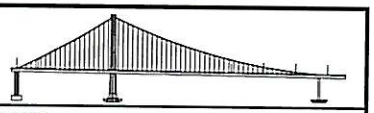


Project: SFOBB Self-Anchored Suspension Bridge | **Contract No.: 04-0120F4**

ID No	Date	Pre-Job	Operator (Name)	Prod Lot	Coupler	Bar (mm)	Position (Horiz / Vert)	Couple Ht	Rebar Ht	Pass / Fail	Comment
31a,b	11/21/07		Jorge Lopez		500/510	43	H	8991323/794011	Tamco 71031	P	
32a,b	11/21/07		Jon Van Brusselen		500/510	43	H	8991323/794011	Tamco 71031	P	
33a,b	12/20/07		Michael Esquer	6	500/510	43	H	8991323/794011	Tamco 61729	P	
33c,d	12/20/07		Brice Mauser	6	500/510	43	H	8991323/794011	Tamco 61729	P	Corrected ID No
34a,b	1/4/08	X	Tim Greenlee		500/520	19	H	691030/691417	Tamco 71987	P	
34c,d	1/4/08	X	Jason Jobe		500/520	19	H	691030/691417	Tamco 71987	P	
35a,b	1/4/08	X	Tim Greenlee		500/510	25	H	691992/794011	Tamco 71711	P	
35c,d	1/4/08	X	Jason Jobe		500/510	25	H	691992/794011	Tamco 71711	P	
36a,b	1/4/08	X	Tim Greenlee		500/510	29	H	599344/794011	Tamco 72888	P	
36c,d	1/4/08	X	Jason Jobe		500/510	29	H	599344/794011	Tamco 72888	P	
37a,b	1/4/08	X	Tim Greenlee		500/510	36	H	691550/794011	Tamco 72888	P	
37c,d	1/4/08	X	Jason Jobe		500/510	36	H	691550/794011	Tamco 72888	P	
38a-d	1/17/08		Lance Gaige	1	500/510	19	H	691030/781465	Tamco 73413	P	
39a-d	1/17/08		Lance Gaige	1	500/510	25	H	691992/794011	Tamco 72212	P	
40a-d	1/17/08		Lance Gaige	7	500/510	43	H	8991323/794011	Tamco 71032	P	Strain OK
41a-d	1/28/08		Lance Gaige	1	500/510	29	H	599344/794011	Tamco 73243	P	

American Bridge / FLUOR. A JOINT VENTURE

Rebar Coupler ID Log



Project: SFOBB Self-Anchored Suspension Bridge | **Contract No.: 04-0120F4**

ID No	Date	Pre-Job	Operator (Name)	Prod Lot	Coupler	Bar (mm)	Position (Horiz / Vert)	Couple Ht	Rebar Ht	Pass / Fail	Comment
42a-d	1/28/08		Lance Gaige	1	500/510	36	H	691550/794011	Tamco 73243	P	
43a-d	3/7/08	X	Lance Gaige		500/520	29	H	793167/794011	Tamco 72856	P	
44a-d	4/17/08	X	Joe Bell		500/520	36	H	257718/794011	Tamco 73111	P	
45a-d	4/22/08		Joe Bell	1	500/520	36	H	257718/794011	Tamco 73506	P	
46a,b	6/2/08	X	Tim Greenlee		500/551	43	V	793561/7440786	Tamco 71032	P	
47a,b	6/4/08		Tim Greenlee		500/551	43	V	793561/7440786	Existing	P	
48a,b	6/4/08		Tim Greenlee		500/551	43	V	793561/7440786	Existing	P	
49a-d	7/3/08	X	Tim Greenlee		500/520	16	H	691417/9B1029	Tamco 81909	P	
50a-d	7/3/08	X	Tim Greenlee		500/520	22	H	793167/A730696	Tamco 81909	P	
51a,b	8/12/08		Lucino Ortiz		410/420	57	H	603421/5M6602	Tamco 72760A	P	
52a,b	8/12/08		Edgar Delana		410/420	57	H	603421/5M6602	Tamco 72760A	P	
53a,b	8/12/08		Roberto Berber		410/420	57	H	603421/5M6602	Tamco 72760A	P	
54a,b	8/12/08		Bob Boganes		410/420	57	H	603421/5M6602	Tamco 72760A	P	
55a-d	9/26/08		Jose Cervantes		500/510	43	H	Existing	Tamco 71064	P	
56a-d	9/26/08		Salvador Ramon		500/510	43	H	Existing	Tamco 71064	P	

MECHANICAL REBAR TESTING
355 SOUTH VASCO ROAD, SUITE R, LIVERMORE, CA 94550
Phone: 925/960-0312 Fax: 925/960-0318

ULTIMATE TEST

Testing For:	American Bridge/Fluor	**Project:**	SFOBB SAS	**Date Tested:**	9/26/2008
Test To:	Caltrans SS No. 52 or Specials	**Project No. :**	04-0120F4	**Witnessed By:**	BDT-1220-08 W
TL-101 :	C613655	**Bridge No.:**	N/A	**Tested By:**	Courtney Meyer
Splice Type:	#14 HRC 500/510 Coupler	**Location of Bar :**	Operator/Production Test	**Checked By:**	Darcy Hassler, PE
Length of Splice:	2.0m	**Bid Item No. :**	48		
Operator:	Jose Cervantes				

		Splice 1	Control Bar	Splice 2	Control Bar	Splice 3	Control Bar	Splice 4	Control Bar
Sample Number		A(55)	AA	B(55)	BB	C(55)	CC	D(55)	DD
Rebar Grade		A706	A706	A706	A706	A706	A706	A706	A706
Mill		Tamco	Tamco	Tamco	Tamco	Tamco	Tamco	Tamco	Tamco
Heat Number		71064	71064	71064	71064	71064	71064	71064	71064
Sample Condition		Good	Good	Good	Good	Good	Good	Good	Good
Visible Defects Prior to Test		None	None	None	None	None	None	None	None
Bar Size	(metric)	#43	#43	#43	#43	#43	#43	#43	#43
	(imp.)	#14	#14	#14	#14	#14	#14	#14	#14
Bar Area	(sq cm)	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
	(sq in)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Slip	(in)	0.0213	N/A	0.02045	N/A	N/A	N/A	N/A	N/A
Load at Ultimate	(lb)	214,930	217,050	216,120	217,990	215,540	218,310	214,160	217,880
Tensile Strength	(MPa)	659	665	662	668	660	669	656	668
	(psi)	95,524	96,467	96,053	96,884	95,796	97,027	95,182	96,836
95% Tensile Strength	(psi)	N/A	91,643	N/A	92,040	N/A	92,175	N/A	91,994
Fracture Type		Ductile	Bar	Ductile	Bar	Ductile	Bar	Ductile	Bar
Dist. From End of Splice to Visible Necking	(in)	25	N/A	28	N/A	33	N/A	17	N/A
Size of Affected Zone	(in)	6.5	N/A	6.5	N/A	6.5	N/A	6.5	N/A
Change in Length	(in)	0.7910	N/A	0.8235	N/A	0.8815	N/A	0.7765	N/A
Strain	(%)	9.89	N/A	10.29	N/A	11.02	N/A	9.71	N/A

Ultimate Tensile Strength for each splice is Greater Than or Less Than 95% of the Ultimate Tensile Strength for its associated Control Bar.

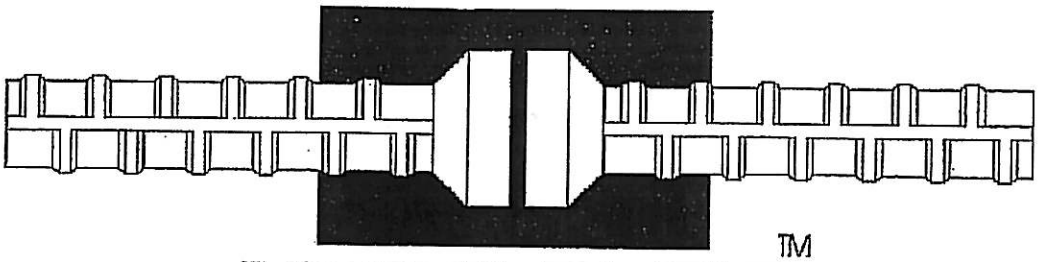
MECHANICAL REBAR TESTING
355 SOUTH VASCO ROAD, SUITE R, LIVERMORE, CA 94550
Phone: 925/960-0312 Fax: 925/960-0318

ULTIMATE TEST

Testing For:	American Bridge/Fluor	**Project:**	SFOBB SAS	**Date Tested:**	9/26/2008
Test To:	Caltrans SS No. 52 or Specials	**Project No. :**	04-0120F4	**Witnessed By:**	BJT-1220-08 DD
TL -101 :	C613655	**Bridge No.:**	N/A	**Tested By:**	Courtney Meyer
Splice Type:	#14 HRC 500/510 Coupler	**Location of Bar :**	Operator/Production Test	**Checked By:**	Darcy Hassler, PE
Length of Splice:	2.0m	**Bid Item No. :**	48		
Operator:	Salvador Ramon				

		Splice 1	Control Bar	Splice 2	Control Bar	Splice 3	Control Bar	Splice 4	Control Bar
Sample Number		A(56)	AA	B(56)	BB	C(56)	CC	D(56)	DD
Rebar Grade		A706	A706	A706	A706	A706	A706	A706	A706
Mill		Tamco	Tamco	Tamco	Tamco	Tamco	Tamco	Tamco	Tamco
Heat Number		71064	71064	71064	71064	71064	71064	71064	71064
Sample Condition		Good	Good	Good	Good	Good	Good	Good	Good
Visible Defects Prior to Test		None	None	None	None	None	None	None	None
Bar Size	(metric)	#43	#43	#43	#43	#43	#43	#43	#43
	(imp.)	#14	#14	#14	#14	#14	#14	#14	#14
Bar Area	(sq cm)	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
	(sq in)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Slip	(in)	0.0221	N / A	0.0201	N / A	N / A	N / A	N / A	N / A
Load at Ultimate	(lb)	214,840	216,350	215,310	217,000	215,060	217,390	214,780	217,920
Tensile Strength	(MPa)	658	663	660	665	659	666	658	668
	(psi)	95,484	96,156	95,693	96,444	95,582	96,618	95,458	96,853
95% Tensile Strength	(psi)	N / A	91,348	N / A	91,622	N / A	91,787	N / A	92,011
Fracture Type		Ductile	Bar	Ductile	Bar	Ductile	Bar	Ductile	Bar
Dist. From End of Splice to Visible Necking	(in)	18	N / A	21	N / A	20	N / A	24	N / A
Size of Affected Zone	(in)	6.5	N / A	6.5	N / A	6.5	N / A	6.5	N / A
Change in Length	(in)	0.8045	N / A	0.8500	N / A	0.8875	N / A	0.8985	N / A
Strain	(%)	10.06	N / A	10.63	N / A	11.09	N / A	11.23	N / A

Ultimate Tensile Strength for each splice is Greater Than or Less Than 95% of the Ultimate Tensile Strength for its associated Control Bar.



XTENDER™

OPERATING MANUAL

For additional information please contact:

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11200 Condor Avenue

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Tel: 1-800-HRC-6775

Fax: 714-557-4460

CONTENTS

PREFACE

Thank-you for selecting the XTENDER™ Mechanical Splicing System. This Operating Manual contains manufacturer's guidelines and recommended practices when using the XTENDER™ system. Understanding this manual will enable operators to work very efficiently, thereby increasing the productivity of this splicing system.

The manufacturer has included general safety precautions throughout this manual. Because of the many different circumstances under which this system may be used, the manufacturer may not be held liable for any accidents or injury caused by any component of the XTENDER™ system. Please keep in mind the fundamental safety regulations of machine tools, especially on operating hydraulic cylinders, clamping assemblies and gas heating equipment. Only manufacturer certified and trained operators should use the XTENDER™ system.

For information on the XTENDER™ system, or for servicing and maintenance of equipment, please contact the manufacturer or authorized representative.

Manual Number: Operating Manual #

Approved Operator: _____

Company: _____

Address: _____

Date: _____

1.0 SAFETY PRECAUTIONS

The following safety information must be strictly observed by all machine operators :

- Carefully read this operating manual before commencement of work.
- Never operate the XTENDER™ equipment without protective equipment such as heat resistant gloves, safety glasses, & safety shoes. Use of back supports is recommended.
- Never touch XTENDER™ equipment, upset bar or coupler components without using heat resistant gloves (i.e. heavy duty leather gloves).
- Components may remain hot for some time after upsetting is complete. Clearly mark work area with caution signs to prevent accidental burns.
- Always disconnect the power supply to the hydraulic pump before inspecting, repairing or performing maintenance to the XTENDER™ machine.
- Never reach into the jaw clamping area when the XTENDER™ machine is connected to the hydraulic pump. Always disconnect pump.
- Continuously observe both the XTENDER™ machine and the hydraulic pump for oil leaks and other signs of excessive wear.
- Exercise extreme caution when handling heating equipment. Gas cylinders must be secured at all times.
- Keep work area clean and clear of flammable material. Keep fire extinguisher within reach at all times.
- Keep all power-cords, hydraulic hoses and torch hoses away from the open flame of the heating tip.
- With continued use, the XTENDER™ machine gets very hot. It is important that the operator cools the machine in a bucket of water periodically to prevent accidental burns.

2.0 XTENDER™ SETUP PROCEDURE

The XTENDER™ Mechanical Splicing System consist of three main pieces of equipment:

- XTENDER™ Upsetting Machine
- Hydraulic Pump
- Gas Heating Equipment

2.1 XTENDER™ Upsetting Machine

Step 1 - Select Proper Machine

HRC currently have three sizes of Xtender upsetting machine. It is important to select the proper machine based on bar size being spliced as outlined in Table 2.1

Upsetter Machine	Bar Sizes	
	US	Metric
XT 15	#5, #6, #7, #8	#16, #19, #22, #25
XT 30	#9, #10, #11	#29, #32, #36
XT 50	#14	#43

Table 2.1 - Types of Upsetting Machines

Step 2 - Select Push Rod and Jaws

Both the standard pusher and the jaws are marked with a number corresponding to the bar size for which they are used. Select the appropriate pusher (push rod) and jaws for the bar being spliced as per Table 2.2.

Bar Size		XT 15		XT 30		XT 50	
US	Metric	Push Rod	Jaws	Push Rod	Jaws	Push Rod	Jaws
#5	#16	5	1516S				
#6	#19	6	1519S				
#7	#22	7	1522S				
#8	#25	8	1525S				
#9	#29			9	3029S		

Table 2.2 - Table of Push Rod and Jaw Size

Cont.

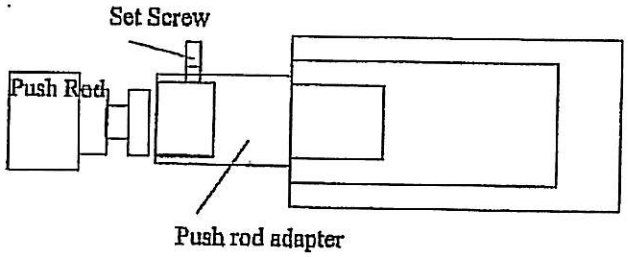
Bar Size		XT 15		XT 30		XT 50	
US	Metric	Push Rod	Jaws	Push Rod	Jaws	Push Rod	Jaws
#10	#32			10	3033S		
#11	#36			11	3036S		
#14	#43					14	5043S

Table 2.2 - Table of Push Rod and Jaw Size

Step 3 - Install Push Rod

Install the pusher into the cylinder push rod adapter. Each bar size has a different type of pusher. See below for correct installation instructions.

XT15/30/50



Installation: Access the set-screw through the vent holes in the machine body. Loosen the screw to allow insertion of the push rod into the push rod adaptor. Tighten the set-screw.

Step 4 - Install Jaws

Carefully inspect the jaw carrier for broken safety pins, springs and set screws. Insert jaw carrier into casing and install the mounting bolts and springs. Secure the jaw carrier to the hydraulic cylinder by tightening the three bolts as shown in Figure 2.1. Tighten bolts only so that head of bolt sits flush with jaw carrier. See Figure 2.1 for pusher and jaw assembly as shown on page 7.

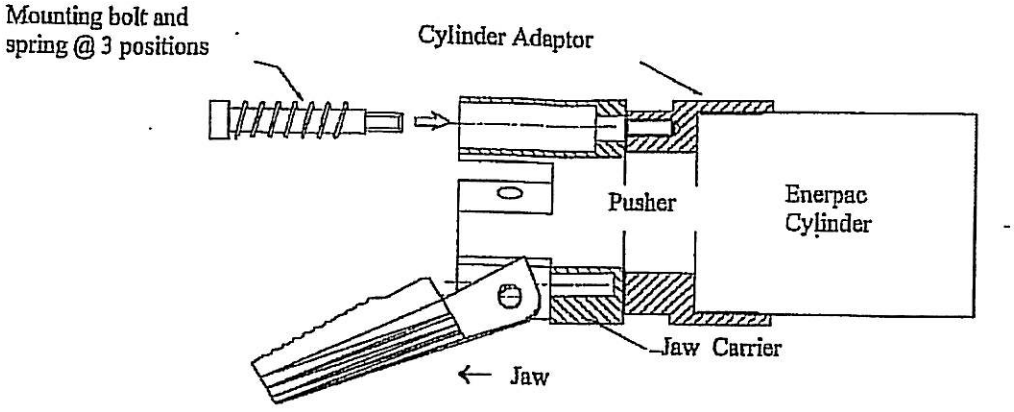


Figure 2.1 - Pusher and Jaw Assembly

Step 5 - Install Front End Cap

Prior to installing the front end cap lubricate the inside of the cap with dry graphite lubricant or high temperature grease. Ensure the threads are clean of debris before installing the end cap. Lubricate end cap periodically to ensure smooth operation of the jaw carrier assembly.

Make sure end cap is clean and dry when applying grease.

2.2 Hydraulic Pump

Step 1 - Select Pump

Ensure the pump is rated for 8000 - 10000 psi and is equipped with a 10000 psi gauge or a 10000 psi preset shut-off valve. If the hydraulic pump cannot reach 8000 psi, then service is due. It is important to select a pump with adequate flow rate as described in Table 2.3.

	Oil Delivery (cu.in./min.@)			
Bar Size	**100 psi**	**700 psi**	**5000 psi**	**10000 psi**
#4(13)-#14(43)	704	440	74	56

Table 2.3 - Minimum Flow Rate Required for 8000- 10000 psi Hydraulic Pump Pressure

Step 2 - Select Hydraulic Hoses

Ensure the hoses are rated for 10000 psi and that all hydraulic hoses and fittings are in good condition. Worn hoses and leaking fittings should be replaced. Ensure the pump is disconnected from power supply whenever connecting or disconnecting hydraulic hoses. Periodically check the condition of hoses and fittings.

2.3 Heating Equipment

Step 1 - Select Gas Type

Although a gas mixture of propane and oxygen is recommended, other mixtures such as acetylene and oxygen may be used. Guidelines for the heating process including nominal heating duration and gas pressures are given in Table 2.4.

Bar Size	Heated Length (inches)	Recommended Burner Number	Propane Pressure (psi)	Oxygen Pressure (psi)	Nominal Heating Duration(sec)
#5 #16	1.25	10	20	60	30
#6 #19	1.50	10	20	60	30
#7 #22	1.75	10	20	60	30
#8 #25	2.00	10	20	60	30
#9 #29	2.00	15	30	80	70
#10 #32	2.00	15	30	80	70
#11 #36	2.00	20	30	80	90
#14 #43	2.50	20	30	80	120

Table 2.4 - Recommended Heating Parameters Using Propane and Oxygen

Step 2 - Safety Precautions

Operators should exercise extreme caution when handling gas cylinders. Cylinders should be properly secured at all times. Remove all flammable materials from work area.

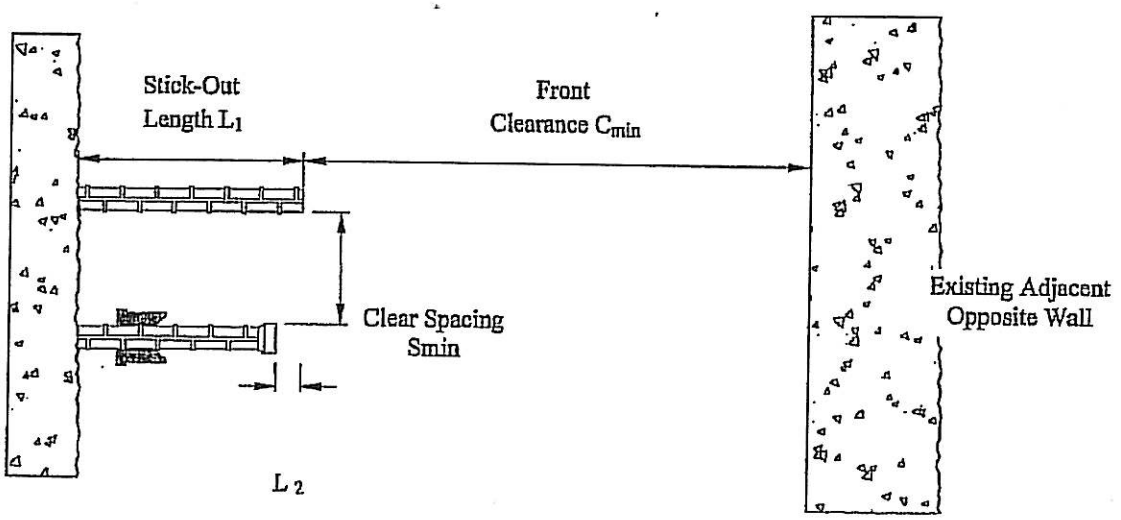
3.0 XTENDER™ SPLICING INSTRUCTIONS

HRC provides training courses for operators/installers and recommends that all personnel involved in the XTENDER™ splicing operation attend such training and receive HRC certificates of competence.

The XTENDER™ Mechanical Splicing System utilizes upset heads formed on one or both ends of the reinforcement bar being coupled. Threaded male and female sleeves bearing on the formed head(s) provide the actual coupling. The proper step-by-step installation instructions are described below.

Step 1

Ensure you have the required bar clearance, front clearance and minimum bar stick out length as per Table 3.1. If end of reinforcement bar is bent, flame cut away the bent portion the bar. Optimum heads are formed on straight sections of reinforcement bar with bar end saw cut, flame cut or cropped.



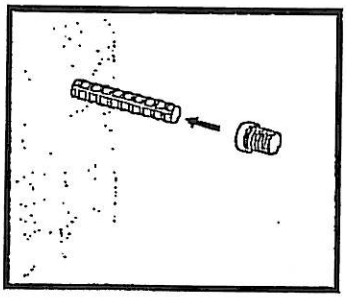
Bar Size US	Bar Size Metric	Min. Stick Out Length L_1	Clear Spacing S_{min}	Material Length Loss L_2	Front Clearance $*C_{min}$
#5	#16	5"	2"	½"	24"
#6	#19	6"	2"	5/8"	24"
#7	#22	6"	2"	5/8"	24"
#8	#25	6"	2"	5/8"	24"
#9	#29	8"	3"	¾"	30"
#10	#32	8"	3"	¾"	30"
#11	#36	8"	4"	¾"	30"
#14	#43	10"	4"	1"	30"

Table 3.1 - Clearance Required for XTENDER™

* **Note :** C_{min} is the minimum required clearance from the end of bar to any existing opposite wall that may obstruct the machine's operation.

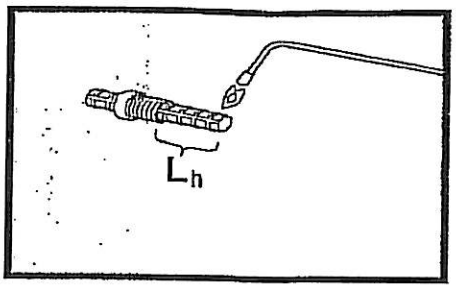
Step 2

Position the coupling nut onto the reinforcement bar being coupled. If the bar has excessive longitudinal ribs, manual grinding should be performed. (See work procedure on page 17).



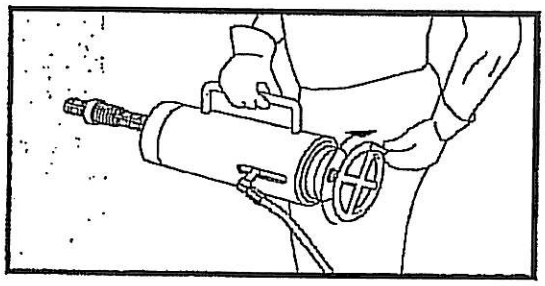
Step 3

Evenly heat approximately 1.5 bar diameter of the end of the bar to the required upset temperature. The correct upset temperature can be easily visually controlled between a bright cherry red and orange yellow. Care should be taken not to overheat the bar. Distortion, or surface melting of the bar end during heating are indications of overheating. If either occurs, remove heat source and check torch tip type and gas pressure settings. Recommended gas pressures, tip recommendations and nominal heating time and length for each bar size are all given in Table 2.4 of page 8.



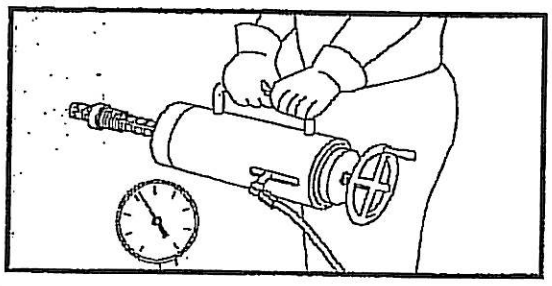
Step 4 & Step 5

Position the correct upsetting machine over the heated end of the bar and push the machine onto the bar or the bar into the machine as far as possible. Maintain alignment of both machine and bar as level as possible. Tighten the machine to the bar by turning the rear wheel clockwise or engage the drive motor to close the jaws on the bar.
For heads formed in a fabrication shop, a feed table should be used to maintain proper horizontal and vertical alignment during heading process. The upsetting machine should always be secured and level before heading the rebar.



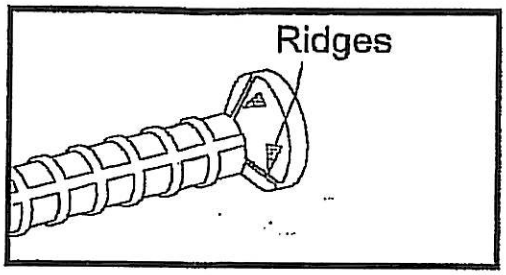
Step 6

Immediately activate the hydraulic pump and apply 8000 to 10000 psi to the end of the heated bar. Release pump pressure once the required pressure is attained.



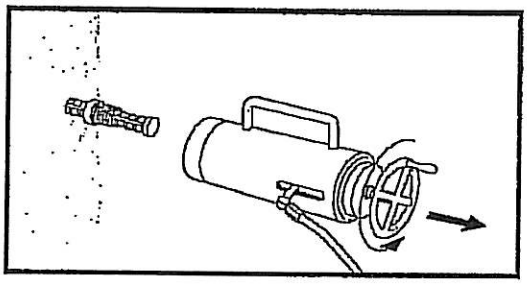
Step 7

Remove the ridges on the conical underside of the head for all 500H/525 series coupler, (if applicable) using mechanical tools or a hand file.



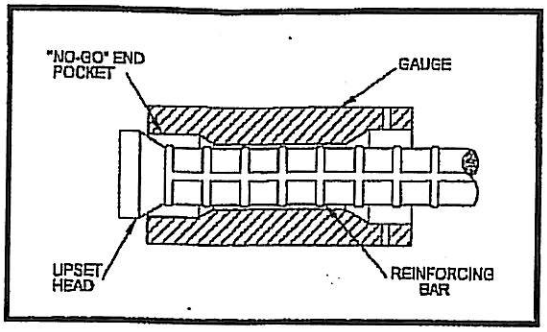
Step 8

Remove the upsetting machine from the bar by turning the rear wheel in the counterclockwise direction or disengage the motor drive. This will cause the jaws to be released from the bar. Move the couplers as far away as possible from the heated area while the bar is cooling. Direct quenching by immersion of the formed head is not recommended. Contacts with water from equipment cooling or environmental conditions (rain or damp weather) is however acceptable. Remove excessive mill scales.



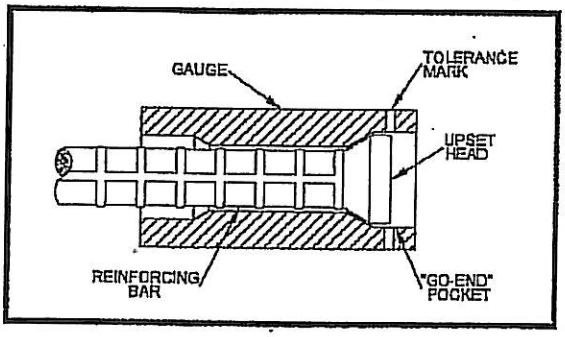
Step 9 Exercise caution!!!!

Before visually checking the upset head, the bar should be cool enough for handling. Use proper gloves. Excessive mill scale should be removed. Offer the "No-Go" end of the inspection gauge up to the completed upset head. The head should not be able to fully enter the gauge pocket. Refer to figure below.



Step 10

Offer the "Go" end of the gauge up to the completed upset head. The head should enter the pocket and the gauge should fit snugly against the reinforcing bar.

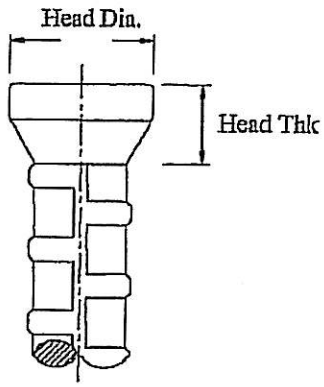


Note that the taper section of the gauge should always be parallel to the conical seat of the upset head at each side of the gauge to ensure correct angle and form of the head. Also, the end of the upset head should fall within the thickness tolerance marked on the gauge.

Step 11 Rejection Criteria for Upset Heads :

- The upset head fully enters the "No-Go" end of the gauge. The upset head is too small.
- The head will not fully enter the "Go" end of the gauge. The head diameter is too large or the head is not concentric with the reinforcement bar.
- The head thickness does not fall within the tolerance zone. The head is too thin or too thick.
- The conical seat does not match the conical part of the gauge. The angle or form of the conical zone is incorrect.
- The upset head has any visible cracking.

Bar Size		Min. Head Thickness		Min. Head Diameter	
US	Metric	inch	mm	inch	mm
#5	#16	0.39	10	0.82	21
#6	#19	0.47	12	0.97	25
#7	#22	0.55	14	1.18	30
#8	#25	0.63	16	1.28	33
#9	#29	0.71	18	1.58	40
#10	#32	0.79	20	1.77	45
#11	#36	0.91	23	1.93	49
#14	#43	1.10	28	2.44	62



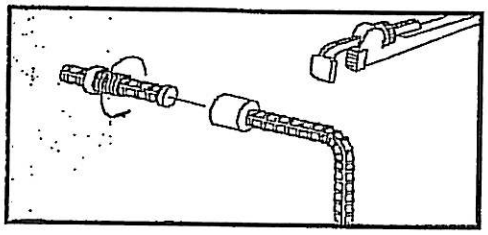
Typ. Head Elev.

Table 3.2 – Minimum Head Dimensions

Table 3.2 shows minimum head dimensions. This information can be used to manually control head sizes. The control of head dimension using the Go/No-Go gauge verifies that the heads are within the tolerances given in the above table.

Step 12 Exercise caution!!!! 

Let the upset heads cool for a minimum of 30 minutes. Remove loose particles from the inside and threads of coupler and on the upset reinforcing bar prior to engaging the male and female parts. Hand-tighten the male and female components together. Full contact between the ends of the upset bars should be observed. Locking of the bars in the coupler indicates this has been achieved. The bars should not be loose in the coupler at this stage. A visible gap (1/16" to 1/2") between the collar on the male coupler and the female sleeve should be expected. The XTENDER™ Splicing System will develop full bar strength when each connection is torqued to the recommended torque wrench setting as shown on Table 3.3 below. When using an adjustable break torque wrench, apply the torque two (2) times and/or until no visible rotation of mating coupler occurs to ensure it has reached the recommended torque.



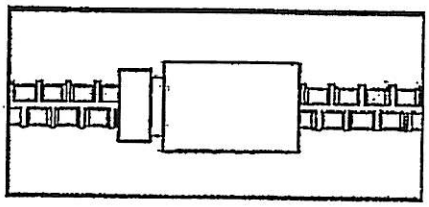
Bar Size		Torque Wrench Settings		Bar Size		Torque Wrench Settings	
		lb-ft	N-m			lb-ft	N-m
#5	16mm	150	203	#9	29mm	250	338
#6	19mm	200	270	#10	32mm	300	407
#7	22mm	200	270	#11	36mm	350	475
#8	25mm	250	338	#14	43mm	400	542

Table 3.3 – Recommended Torque Wrench Settings

Step 13

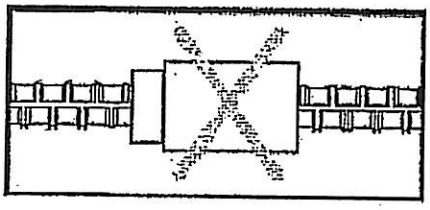
Compare the actual connection with Detail 12A, 12B and 12C to verify acceptance. Detail 12A shows a proper connection with a gap between the collar on the male nut and end of female sleeve. Either the situation of Detail 12B where the male and female components are screwed completely together or Detail 12C which shows more than one exposed thread on the male nut is unacceptable, and indicates a wrong formed head. Refer to trouble shooting guide for causes and solutions for malformed heads.

12A



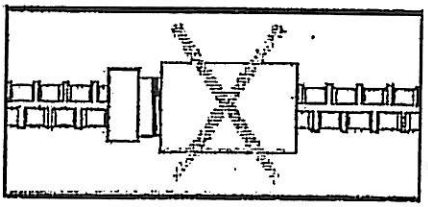
Correct. Optimum head size.

12B



Incorrect. Head size too small.

12C



Incorrect. Head size too large.

3.1 PROCEDURE FOR RE – WORK ON FAULTY HEADS

3.11 Introduction.

When using HRC 500 series bar splicing system. It is occasionally necessary to re-work heads that have been badly formed due to operator error or equipment failure. HRC recommends that the faulty head is completely removed and a new head is formed on the bar end.

3.12 Procedure.

1. Use measurement and /or HRC gauge to determine heads that need to be re-formed. Mark faulty heads with spray paint.
2. Ideally remove 2 – 3 inches of bar end including the faulty head.
3. If removing 2 – 3 inches would cause the bar to be too short (bars protruding from concrete for example), it is perfectly acceptable to remove only the faulty head. In this case, cut the bar at the transition from parallel bar to taper cone at the back of the head.
4. Shear-cut, saw-cut, disc-cut, or flame-cut are all acceptable methods for removing faulty heads. The cut bar end should however be reasonably square.
5. Re-form bar end using normal Xtender™ procedures.

3.2 PROCEDURE FOR REMOVING EXCESSIVE RIBS

3.21 Applicability

X-tender ™ components are dimensioned to fit over rebar of dimensions normally supplied by rebar producers. On infrequent occasions, a heavy longitudinal rib may be present. In these cases it may be necessary to remove some of this excessive rib by manual grinding.

3.22 Equipment

HRC recommend using electric or air driven angle grinder of size range 4 – 9 inch, fitted with regular metal "grinding" disc.

3.23 Procedure

After ensuring the rebar being worked on in a steady position, evenly grind the longitudinal ribs alternating between them, for a length of approximately 10 to 14 inches. It is only necessary to remove enough material to allow the coupler to slide loosely over the bar. During grinding, the coupler can be tried periodically to see if enough material has been removed. Removing some more material than necessary has no negative effect. However, grinding should not be so excessive as to remove material from the base bar diameter. Care should be taken to ensure that grinding is limited to the longitudinal ribs and that the base bar is not inadvertently grinded or gouged.

4.0 TROUBLE SHOOTING

The following section outlines some problems that can occur along with likely reasons and solutions to overcome such problems. Operator should use this guide or consult with manufacturer if problems occur with XTENDER™ Splicing System

Problems	Reasons	Solutions
Bar not being gripped by jaws	1. Incorrect size jaws	1. Select proper jaw size
	2. Excess mill scale on jaw serration	2. Clean jaw serration
	3. Undersized Bar	3. Use undersized jaws
	4. Jaws stripped	4. Replace jaws
	5. Broken pins in jaw carrier	5. Replace pins in jaw carrier
Upset head too thick	1. Bar not hot enough to upset	1. Heat bar to cherry red (orange)
	2. Incorrect jaw size	2. Select proper jaw size
	3. Incorrect pusher size	3. Select correct pusher size
	4. Jaw carrier not secured to hydraulic cylinder	4. Tighten bolts on jaw carrier and secure adapter plate to cylinder by turning jaws clockwise.
	5. Incorrect hydraulic pump/pressure	5. Check pump capacity and flow rate. Always use 10000 psi.
Upset head too thin	1. Incorrect pusher size	1. Select correct pusher
	2. Bar not fully inserted in machine	2. Insert bar all the way into the machine
	3. Bar slipping in the jaws, 3. jaws not tight on bar, undersized bar	3. Tighten jaws on bar by turning rear wheel clockwise
	4. Excess mill scale on jaws	4. Clean jaws with wire brush
	5. Bar end not straight	5. Flame cut bar end

Problems	Reasons	Solutions
Head diameter too large, head will not fit properly in coupler	1. Broken pins in jaw carrier	1. Replace broken pins in jaw carrier
	2. Oversized bar	2. Grind irregular deformations from bar
	3. Incorrect jaws	3. Use correct jaws
	4. Incorrect pusher	4. Use correct pusher
Bar jamming in head cup	1. No lubricant on front end cap	1. Lubricate inside of front end cap
	2. Excess dirt and mill scale	2. Loosen adjusting bolt and clean front end cap
	3. Jaws jammed on irregular bar deformations	3. Tap bar with hammer to break jaws free from bar
No pump pressure showing on gauge	1. Bar slipping in jaws	1. Tighten jaws on bar
	2. No pusher installed	2. Use correct pusher for bar size used
	3. Pump low on hydraulic oil	3. Check/refill hydraulic oil
	4. Leak in hydraulic system	4. Check hoses / fitting for leaks
	5. Pump/gauge not working	5. Replace pump/gauge
Leaking seals on hydraulic cylinder	1. Overheating of machine	1. Keep machine cool by periodically submerging the machine in water.
Shearing off bolts in jaw carrier	1. Over size bar	1. Grind deformations from bar
	2. Jaws not tightened on rebar	2. Ensure jaws are tight on bar
	3. Incorrect pusher	3. Use correct pusher size
	4. Bent bar	4. Heat and straighten bar
Pusher will not retract.	1. Loose hose couplings	1. Tighten hose couplings with wrenches.

5.0 RECOMMENDED EQUIPMENT

5.1 Recommended Hydraulic Pumps

To ensure proper head formation it is essential to use hydraulic pumps with adequate capacity and flow rate. The minimum flow rate required for the hydraulic pump at maximum rated pressure of 10000 psi is given in Table 2.1. In addition, a list of recommended hydraulic pumps is given in Table 5.1. This list is to be used as a guide when selecting a proper hydraulic pump but does not necessarily include all acceptable pump models. Operators may use other types of pumps if deemed compatible with any of the listed models.

Flow Rate	Power	Manufacturer	Model #	Pump Control	Weight
30 in^3 / min	Electric	Power Team	PE 302A	Remote	41 lbs
50 in^3 / min	Electric	Simplex	PEM 7032	Remote	71 lbs
50 in^3 / min	Gasoline	Simplex	PGM 4032	Manual	53 lbs
55 in^3 / min	Gasoline	Enerpac	PGM-3310R	Manual	93 lbs
55 in^3 / min	Electric	Power Team	PE 552A	Remote	65 lbs
60 in^3 / min	Electric	Enerpac	PUD-3105	Remote	63 lbs

Table 5.1 – Recommended Hydraulic Pumps

6.0 TRAINING AND CERTIFICATION

Each operator of the XTENDER™ equipment is advised to complete the manufacturer's training course that consists of learning the correct operating procedure, safety regulations and an overview of systems components. This course will enhance operator confidence and will ensure quality fieldwork. Upon successful completion of the training course, the operator will receive a certificate of competence as an XTENDER™ operator.

AMERICAN BRIDGE/FLUOR ENTERPRISES, a JV
P.O. BOX 23223 Oakland, CA 94623
Phone (510) 419-0120 / Fax (510) 839-0666

NCR PROPOSED RESOLUTION

To: CALTRANS - SAS Superstructure
333 Burma Road
Oakland CA 94607

Attention: Siegenthaler, Peter
Resident Engineer

Ref: 05.03.06-000167

Subject: NCR No. ABF-0004

Dated: **22-Feb-2011**
Contract No.: 04-0120F4
04-SF-80-13.2 / 13.9
Job Name: SAS Superstructure
Document No.: **ABF-NPR-000166 Rev: 01**

Contractor's Proposed Resolution:

Reference Resolution: "Please find attached a copy of Goodwin formal response to NCR#-0004 regarding local heat treatment of weld repair.

"Please find attached a copy of Goodwin formal response to NCR#-0004 regarding local heat treatment of weld repair. Also attached are copies of the re-issued WP006 and check-sheet that have been implemented at Goodwin International."

Submitted by: Kanapicki, Charles

Attachment(s): ABF-NPR-000166R01; ; ;

Caltrans' comments:

Status: CLO

Date: 02-Mar-2011

Retracted by ABF.

Submitted by: Maestas, Reba

Date: 02-Mar-2011

Attachment(s):

GOODWIN

Goodwin Steel Castings Ltd
Ivy House Road
Hanley
Stoke-on-Trent
Staffordshire
ST1 3NR
Tel: +44 (0)1782 220000
Fax: +44 (0)1782 208060

Quality Control Manager
American Bridge/Fluor Enterprises Inc. A Joint Venture
375 Burma Road
Oakland, CA 94607

February 21st, 2011

REF: NCR-000977 – GSC-0004

For the Attention of Mr. C. Kanapicki,

Dear Sir,

In response to ABF / Caltrans Non-conformance Report – GSC-0004, issued to Goodwin and received 15th February 2011, Goodwin Steel Casting Ltd have now completed our internal review of local heat treatment practice with subcontractor – Goodwin International Ltd.

Upon completion of our review, Goodwin International have conducted a complete review of heat treatment practice and Work Procedure – WP006 Issue 5, dated 31st January 2011 has been issued, a copy is attached for your records.

Sub-section 2 of Works Procedure WP006 gives specific instructions to be followed for Local Post Weld Heat Treatment. Internal training has been completed with Goodwin International welding personnel to ensure conformance.

Additionally, a check-sheet has been implemented to record visual checks during local post weld heat treatment cycles. Welding personnel are required to visual check and record the surface temperature of the casting within the heating pad location(s) every 30 minutes. Temperature checks are conducted using either Tempil Sticks or Calibrated Infra-red hand held pyrometer.

The surface temperature recorded will be verified against the contact thermocouple placed on the casting to ensure that there is no deviation exceeding the specified program set-point and post weld heat treatment range specified within WP006 and/or the relevant WPS applicable to the weld repair conducted. Should any deviation greater than that specified on the relevant WPS be found on casting surface and contact thermocouple temperature the heat treatment will be stopped immediately. A copy of the check-sheet is attached for your records.

Following discussion with Caltrans onsite inspector, implementation of WP006 Issue 5, check-sheet, and internal training, local post weld heat treatment has now re-commenced successfully with no reported deviations with castings surface and thermocouple temperature readings.

Best Regards,

J. Cross

Jason Cross
Q. A. Manager
Goodwin Steel Castings Ltd.

Goodwin International - Oakland Bay Bridge

Job No. :					Dated : / /2011		
Cable Band Type:					Panel Point No:		
Ramp Rate	100°C per Hour		Heat Treatment Temp.	630°C		Soak Time	3 Hours

If Temperature of 650°C is exceeded turn off (as noted with either Temple Stick or Infra Red HT Gun)

30 minute Time Check	Excavation No. (s)	**Method of Check**	Temple Stick used or Temp Recorded	Result of Check (Accept / Reject)	Sign Off	Name	Clock No
Starting Time		Temple Stick or Infra-red HT Gun					

Goodwin International
Newstead, Trentham, Stoke-on-Trent, England.

Heat Treatment (Post weld overlay and repair)

WP006 – Issue 5

Issue/Revision	Date	Comments	Prepared	Reviewed & Approved
Issue 5 Rev 0	31/01/11	Complete Review and amendment following reassessment of HT Practices and requirements including training & competency	A. Parsons	L. Inglis

0.0 SCOPE

0.1 This procedure details the methods and requirements for the internal heat treatment of welds including overlay and casting repair welds. The specific heat treatment temperatures and holding times are detailed on the relevant weld procedures.

0.2 The procedure encompasses the requirements and processes associated with both fixed Furnace (Sub-Section 1) and localised portable (Sub-section 2) Post Weld Heat Treatment (PWHT) methods.

0.3 Localised Heat Treatment is normally only to be used for the in-situ treatment of fabrications and weld repairs where furnace Post weld Heat Treatment is not practical due to component size or configuration.

0.4 **Reference Documents**:

- WP011: Goodwin International Works Procedure – Weld Repair
- WP012: Goodwin International Works Procedure – Gauge Control
- WP006/F1: Heat Treatment Form 1 - Furnace Log Load Register sheet
- WP006/F2: Heat Treatment Form 2 – Furnace HT Record sheet (Fabrications & repairs)
- WP006/F3: Heat Treatment Form 3 - Furnace HT Record sheet (Weld overlays)
- WP006/F4: Heat Treatment Form 4 – PWHT Authorisation Matrix
- WP006/F5: Heat Treatment Form 5 – Local HT Log Register sheet
- WP006/F6: Heat Treatment Form 6 – Local HT Record sheet (Fabrications & repairs)

SUB-SECTION 1: PWHT USING FIXED FURNACES

1.1 EQUIPMENT

1.1.1 Goodwin International utilises the following equipment types to facilitate Furnace Heat Treatment. For ease of identification some equipment types are coded, if required, and as detailed below:

- Heat Treatment Furnaces (Coded HTF1 – HTF**)

1.1.2 All Furnaces and ancillary control equipment, including chart recorders, policeman and controllers, are subject to calibration on an annual basis. Calibration shall be controlled in accordance with WP012.

1.1.3 Where a furnace survey is require the acceptable tolerance on achieved readings shall be +/- 13.9°C.

1.1.4 The acceptable tolerance for control graph printers, gauges and temperature controls shall be +/- 1%.

1.2 RESPONSIBILITIES/PERSONNEL

1.2.1 It is the responsibility of the Managing Director and/or his delegated representative to ensure that, by reference to the relevant Procedures/specifications/drawings, that the correct treatment is identified and applied to any specific part, component or contract/job. In the event of a Procedure/Specification/Drawing not being in existence, the Quality Assurance Department must be consulted prior to the initiation of PWHT.

1.2.2 It is the responsibility of the Managing Director and/or his delegated representative(s) to monitor and ensure that the Furnace Load information is recorded in the Heat Treatment Master Furnace Log Records, using the WP006/F1 log master form prior to the initiation of heat treatment cycles.

1.2.3 **Heat Treatment of Fabrications and Weld Repairs**:

1.2.3.1 With regard to fabrications and/or weld repairs a record of the heat treatment shall be made using Quality Control Form WP006/F2. A WP006/F2 shall be completed for each **JOB NUMBER** heat treated. It **is not** acceptable, for HT of fabrications and weld repairs, to complete one WP006/F1 form when multi jobs are heat treated in one furnace load. A WP006/F2 form is needed for each job number included in the multi load.

1.2.4 **Heat Treatment of Weld Overlays**:

1.2.4.1 With regard to weld overlays a record of the heat treatment shall be made using Quality Control Form WP006/F3. A WP006/F3 shall be completed for each **FURNACE LOAD** heat treated. It **is** acceptable, for HT of weld overlays, to complete one WP006/F3 form when multi jobs are heat treated in one furnace load.

1.2.4.2 The Managing Director and/or his delegated representative(s) may delegate duties/responsibilities as required. However all personnel must be trained and authorised to perform the delegated duties associated with the internal heat treatment process.

1.2.4.3 **Furnace Programmers**

1.2.4.3.1 The programming of the furnace shall only be performed by personnel trained and authorised to do so. Personnel programming furnaces prior to the introduction of issue 5 Revision 0 of WP006, and who have over 3 years experience of such programming, shall be deemed trained and competent based on that experience. All new programmers must undergo formalised training including practical training on a minimum of 5 jobs, under the supervision of an experience/authorised programmer. This training must be documented. Furnace programmers are, by default, also authorised to initiate heat treatment cycles.

1.2.4.3.2 Programming of furnaces is deemed to include the setting of electronic systems, the installation of program discs or the setting of gauges or parameters by any other means.

1.2.4.3.3 It is the responsibility of the programmers to ensure that the correct heat treatment cycle is set as per the relevant Weld Procedure (WPS) or work instruction.

1.2.4.4 **Furnace Operating Personnel**

1.2.4.4.1 The initiation of heat treatment cycles/programmes shall be performed by personnel trained and authorised to do so. This authorisation is restricted to starting furnaces in accordance with set/established programmes. Such personnel are not authorised to change or amend programmes. Personnel operating furnaces prior to the introduction of issue 5 Revision 0 of WP006, and who have over 3 years experience of furnace operation, shall be deemed trained and competent based on that experience. All new furnace operating must undergo formalised training including practical training on a minimum of 5 jobs under the supervision of an experienced/authorised operator and/or programmer. This training must be documented.

1.2.4.5 **Furnace Loading Personnel**

1.2.4.5.1 The loading of furnaces may be performed by authorised programmers, authorised furnace operators or delegated to non authorised personnel providing it is performed under the control of, or checked by, an authorised programmer and/or operator prior to the inception of any heat treatment cycle..

1.2.5 Both Programming and operating personnel are automatically authorised to record all applicable data and make recording entries as required. The recording of data forms part of the aforementioned training cycle (or previous experience routing) as applicable.

1.2.6 A record of personnel listings and applicable authorisations (relevant to modules/tasks listed in 1.2.4 above) shall be maintained on the authorisation/training matrix form (WP006/F4). Authorisations shall be validated/given by the Manager responsible for Heat Treatment and/or a Company Director.

1.3 SYSTEM/PROCESS

1.3.1 Each heat treatment load number is to be numbered sequentially. The numbering method shall be based on the furnace number, the year, the month, and a four figure sequential load number (i.e. **01/11/0001** is Furnace No. 1/Year 2011/Load Number 1).

1.3.2 A master log for each furnace, detailing the load number and sequential patterns utilising WP006/F1 forms, is located adjacent to each furnace. (Note: This numbering system is only introduced at the introduction of issue 5 Revision 0 of this procedure)

1.3.3 A Quality record form WP006/F2 and/or WP006/F3, as detailed in 1.2.3 or 1.2.4 above shall be completed as applicable to the component type(s) being heat treated. The Quality record forms should be filed within the master file retained in the heat treatment area. A single load code may require the completion of several WP006/F2 forms if the load content spans various fabrication or weld repair job numbers.

1.3.4 On completion of the PWHT cycle the WP006/F2 and or WP006/F3 form must be signed off by the relevant manager, supervisor, authorised programmer and/or an Furnace operator.

1.3.5 The furnace controllers (policemen) are an aid to prevent the furnace 'running away' should the main controllers fail. These policemen should be set in the range of 20-40°C above the main controller temperature.

1.3.6 The furnace recording thermocouples are located at the top area of each furnace in fixed location. (Gas furnace – in the top. Electric furnace- in the side at the top). Any visible damage to thermocouples must be reported to the QC department immediately for action.

1.3.7 All furnaces shall be operated in accordance with the manufacturer/supplier instructions. Furnaces shall only be operated by personnel who have been trained in their specific operation (see 1.2.4 above).

1.3.8 The loading of furnaces may be delegated to non authorised personnel providing it is performed under the control of, or checked by, an authorised operator prior to the inception of any heat treatment cycle.

1.3.9 Gas fired furnaces – the flame must not impinge directly onto the item being heat treated.

1.3.10 Items being heat treated must sit on refractory bricks or grid specifically designed for the furnace.

1.3.11 Items shall be at least 75mm from the furnace wall on loading.

1.3.12 Loading of the furnace shall be as even as possible to ensure equal heating.

1.3.13 Heat treatment shall be carried out as per the information on the relevant weld procedure, with the following general parameters being followed:

a) Correct Furnace program(s) as detailed on the relevant weld procedure (WPS).
Note: Where furnace pre-heat or multiple programmes are required, any interim program changes may only be performed by authorised programmers – see 3.4.1. (This does not apply to the use of multi pre-set programmes).

b) Heating rates shall be as stated on the relevant WPS. Where the WPS does not state a defined heating rate then the heating rate should not exceed 400°C per hour.

c) Cooling rates shall be as stated on the relevant WPS. Where the WPS does not state a defined cooling rate then the furnace shall be gradually cooled at a controlled rate prior to opening the door/lid.

d) During heat treatment cycles the tolerance regarding the oven temperature shall be as stated on the relevant WPS. Where the WPS does not state an acceptable tolerance, then a tolerance of +/- 14.0°C of the temperature required shall be applied.

1.3.14 After heat treatment the log number and date are to be entered onto the HT control graph/chart. When graphs/charts are finished, they are to be handed to the QA department for filing/archiving.

SUB-SECTION 2: PWHT USING LOCAL AND/OR PORTABLE METHODS

2.1 EQUIPMENT

2.1.1 The localised/portable heat treatment unit shall consist of a means for setting the treatment parameters, a means for generating the PWHT control graph and a suitable power source.

2.1.2 For ease of identification some equipment types are coded, if required, and as detailed below

- Heat Treatment Chart (Graph) Recorders/printers (Coded **HTCG1 – HTCG****)
- Heat Treatment Portable Control Panels (Coded **HTCP1 – HTCP****)
- Heat Treatment Portable Power Units (Coded **HTPU1 – HTPU****)

2.1.3 Control units, graph machines and power units shall be calibrated on a minimum of an annual basis.

2.1.4 The acceptable tolerance for gauges and temperature controls shall be +/- 1.0%.

2.1.5 Calibration on the achieved heat output tolerance on achieved readings shall be +/- 14.0°C.

2.1.6 In addition to the base equipment given above, the Company shall stock suitable remote heat treatment pads applicable in size and scope relevant to the Company's requirements for localised PWHT. These shall be maintained in good working condition.

2.2 RESPONSIBILITIES/PERSONNEL

2.2.1 It is the responsibility of the Welding Manager and/or supervisor to ensure that, by reference to the relevant procedures/specifications/drawings, that the correct treatment is identified and applied to any specific part, component or contract/job. In the event of a procedure/specification/drawing not being in existence, the Quality Assurance Department must be consulted prior to the initiation of PWHT.

2.2.2 It is the responsibility of the Welding Manager and/or supervisor to monitor and ensure that each localised heat treatment applied is registered in the master Localised Heat Treatment Log form WP006/F5 (Local PWHT Specific) prior to the initiation of the heat treatment cycles. The heat treatment log number must be entered back on to the applicable weld repair form for cross reference purposes.

2.2.3 A Quality Control Form (WP006/F6) is to be completed for **each <u>WELD REPAIR FORM</u>** detailing a localised heat treatment requirement.

2.2.4 The Welding Manager and/or supervisor may delegate duties/responsibilities as required. However all personnel must be trained and authorised to perform the delegated duties associated with the localised heat treatment process.

2.2.4.1 **Localised Heat Treatment Personnel**

2.2.4.1.1 Localised or portable PWHT shall only be performed by personnel trained and authorised to do so.

2.2.4.1.2 The training and authorisation shall encompass the positioning of HT pads and the setting of test parameters on the control equipment and shall include familiarisation with the relevant equipment and operating methodology.

2.2.4.1.3 This training and authorisation is restricted to local/portable heat treatment methods

2.2.4.1.4 Personnel performing local/portable PWHT prior to the introduction of issue 5 Revision 0 of WP006, and who have over 3 years experience of such heat treatment methods, shall be deemed trained and competent, reference the requirement in 2.2.4.1.1 above, based on that experience. All new local heat treatment personnel must undergo a minimum of one months training under the supervision of an experienced operator. This training must be documented.

2.2.5 Local Heat treatment personnel are automatically authorised to record all applicable data and make recording entries as required. The recording of data forms part of the aforementioned training cycle (or previous experience routing) as applicable.

2.2.6 A record of personnel listings and applicable authorisations (relevant to 2.2.4 above) shall be maintained on the authorisation/training matrix form (WP006/F4). Authorisations shall be validated/given by the Manager responsible for Heat Treatment and/or a Company Director.

2.3 SYSTEM/PROCESS

2.3.1 Each localised heat treatment process is to be numbered sequentially. The numbering method shall be based on the process, the year, the month, and a four figure sequential number. (i.e. **LHT/11/0001** is Localised Heat Treatment/Year 2011/Sequential Number)

2.3.2 A master log detailing the sequential local HT number utilising the WP006/F5 forms, is located adjacent to the weld repair area. (Note: This numbering system is only introduced at the introduction of issue 5 Revision 0 of this procedure)

2.3.3 A WP006/F6 form, as referenced in 2.2.3 above, shall be completed for each **WELD REPAIR FORM** instructing the requirement for localised heat treatment. The WP006/F4 forms should be filed in numerical order within the master WP006/F6 file retained in the weld repair area.

2.3.4 The localised PWHT process shall be accomplished by the use of suitable remote heat treatment pads. The pad(s) shall be of sufficient size to cover the relevant weld area(s) and heat affected zone. Insulation shall be applied to the outer face of the HT pad.

2.3.5 The pad(s) shall be connected to the calibrated power source and its associated control equipment.

2.3.6 The control panel shall be set in accordance with the PWHT requirements mandated by the applicable Weld Procedure (WPS) determined in accordance with the relevant governing standard and or customer instructions/requirements.

2.3.7 The treatment parameters including the temperature ramp up/ramp down rates, the required HT temperature and the soak/hold time required shall be as detailed in the relevant WPS. Where the WPS does not dictate the actual parameters required, the parameters used shall be set by personnel trained and authorised to do so (see 2.2.4).

2.3.8 Once the pads are correctly positioned and the test parameters set the HT process may begin.

2.3.9 During heat treatment cycles the tolerance regarding the applied temperature shall be as stated on the relevant WPS. Where the WPS does not state an acceptable tolerance, then a tolerance of +/- 14.0°C of the temperature required shall be applied.

2.3.10 On completion of the PWHT cycle the WP006/F6 form must be signed off by the relevant manager, supervisor and/or authorised operator.

2.3.11 Following completion of the heat treatment the log number and date are to be entered onto the HT control graph/chart. When graphs/charts are finished, they are to be handed to the QA department for filing/archiving.

3.0 QUALITY DEPARTMENT SUPPORT

3.1 In the event of a failed, incomplete or ineffective heat treatment cycle, the occurrence should be reported to the QA department for investigation and a decision on remedial, ongoing or further actions.

3.2 Where the heat treatment parameters are not clear or are absent from the relevant WPs the QA department should be contacted to provide clarification.

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DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Office of Structural Materials
Quality Assurance and Source Inspection

Bay Area Branch
690 Walnut Ave.St. 150
Vallejo, CA 94592-1133
(707) 649-5453
(707) 649-5493

Contract #: 04-0120F4
Cty: SF/ALA Rte: 80 PM: 13.2/13.9
File #: xx.25A

QUALITY ASSURANCE -- NON-CONFORMANCE RESOLUTION

Location: W2 Cap Beam, SFOBB
Prime Contractor: American Bridge/Fluor Enterprises, a JV
Submitting Contractor: American Bridge/Fluor Enterprises, a JV

Report No: NCS-000105
Date: 03-Oct-2008
NCR #: ABF-0004

Type of problem:

Welding	☐	**Concrete**	☑	**Other**	☐	
Welding	☐	**Curing**	☐	**Procedural**	☐	**Bridge No:** 34-0006
Joint fit-up	☐	**Coating**	☐	**Other**	☐	**Component:**
Procedural	☐	**Procedural**	☑	**Descripton:**		

Date the Non-Conformance Report was written: 27-Aug-2008

Description of Non-Conformance:

For the W2 Cap Beam, Pour 3, top mat, the Contractor fabricated non-conforming male coupler heads for #43 transverse rebar HRC couplers at the job site, which were then tested as completed work. Each of four Quality Assurance (QA) samples failed QA testing for slip: the smallest margin of failure was 60%; the largest, approximately 300%. Evaluation of the samples found defective workmanship, including ridges not ground and improperly formed "mushroom" heads; please see picture. The Contractor has stated that a large proportion of male heads are believed to have ridges not properly ground. ABF-RFI-1494 states that because of these problems, the work is incomplete, and requests re-sampling and re-testing.

Contractor's proposal to correct the problem:

Re-work coupler heads to bring them into conformance. METS understands that the Engineer will revoke relevant fabrication operator qualifications and work will proceed per METS response to ABF-RFI-1494, as previously agreed:

1. The Contractor shall disassemble all coupler heads and inspect, repair, and if necessary re-work all noncompliant heads.
2. The Contractor shall complete work with qualified and/or re-qualified operators.
3. The Contractor shall submit all standards for QC and QA sampling and testing in conformance with the contract requirements to inspect completed heads, including the relevant dimensions and drawings.
4. Couplers shall then be re-installed upon acceptance of re-worked heads and clearing of the to-be-issued Non-Conformance Reports (NCR).
5. Re-work is considered submission of new work to the Department, and will require both QA and QC testing.
6. Should either of the QC or QA tests fail, the Contractor shall remove and discard all the heads and re-do the work.
7. Written authorization from HRC is required to re-use the currently installed couplers. If such authorization is received, all coupler components shall be inspected by the Contractor for damage such as, but not limited to, gouges, bending, dents, etc.

QUALITY ASSURANCE -- NON-CONFORMANCE RESOLUTION

(Continued Page 2 of 2)

8. Couplers may only be re-installed upon acceptance of the reworked heads and clearing of all NCRs.

Corrective action taken:

This NCR specifically dealt with ABF releasing substandard material to the Department. Regional Steel successfully repaired the deficient components, and random QC and QA samples, taken in accordance with Standard Specifications and Special Provisions, passed all QC and QA testing. Since the these componentes were never assembled with their corresponding sockets, manufacturer permission for re-use was was not needed. The Engineer has accepted the components.

Did corrective action require Engineer's approval? ☑ **Yes** ☐ **No**

If so, name of Engineer providing approval: Gil Klebanov **Date:** 29-Aug-2008

Is Engineer's approval attached? ☐ **Yes** ☑ **No**

Comments:

This report is for the purpose of determining conformance with the contract documents and is not for the purpose of making repair or fit for purpose recommendations. Should you require recommendations concerning repairs or remedial efforts please contact Venkatesh Iyer, (858) 967-6363, who represents the Office of Structural Materials for your project.

Inspected By:	Petrina,Markian	Quality Assurance Inspector
Reviewed By:	Iyer,Venkatesh	QA Reviewer