SARGENT & LUNDY
ENGINEERS
CHICAGO

ENGINEERING EVALUATION REPORT FOR CONTAINMENT TENDON WIRE STRENGTH

LASALLE COUNTY STATION, UNITS 1 & 2
JOB NO. 8406-20

PREPARED FOR
COMMONWEALTH EDISON COMPANY

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NUCLEAR SAFETY-RELATED

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1. INTRODUCTION AND SUMMARY

During in-service inspections (ISI) of the post-tensioning system of the LaSalle County Station (LSCS) for Unit 1 (10th year) and for Unit 2 (5th year), the tensile test results for two wire samples fell slightly below the required technical specification minimum value. The laboratory testing of the tendon wire samples indicated that two out of a total of twelve samples did not meet the minimum tensile strength value of 240 ksi. Three samples from each wire were tested and the other two samples taken from the same wires for both tendons met the required minimum tensile strength. The two samples below 240 ksi were from vertical tendon V22A of the Unit 1 containment, and from vertical tendon V231C from the Unit 2 containment. The tested strengths for these two samples were 239.5 ksi (0.2% low) and 237.0 ksi (1.25% low), respectively. Technical Specification 4.6.1.5 requirements were met except for the wire test results.

In accordance with LSCS Technical Specification 4.6.1.5, we have evaluated the containment considering these wire test results and find that the containment is above the required level of integrity. The evaluation of the containment integrity was based on a detailed review of: a) the wire tensile strength test results from the tendon inspections and from the CMTRs obtained for these tendon wires before installation, b) evaluation of the containment tendon wire tensile properties to determine the variation in the tested strengths, c) tendon lift-off forces measured during the current surveillances and all surveillances conducted to-date with respect to their predicted values, d) visual inspections and filler grease laboratory test results, and e) design of the containment system.

2. CONTAINMENT DESCRIPTION

The LaSalle primary containment consists of a steel dome drywell head anchored to a post-tensioned concrete containment shell monolithically supported on a reinforced concrete basemat and is shown in Figure 1. The containment was designed for an accident pressure of 45 psig along with appropriate concurrent loads and load factors listed in FSAR Table 3.8-3 and Design Assessment Report (DAR) Table 4.1-1. Nonprestressed reinforcing steel is provided in the prestressed containment shell to carry flexural stress at points of discontinuity such as penetrations and the wall-basemat junction, and to distribute strains due to shrinkage and temperature.

The post-tensioning system is shown in Figure 2 and consists of:

a. 174 hoop (horizontal) tendons placed in a 240° system below elevation 792' and 14 hoop tendons in a 360° system above elevation 792'.

b. 120 meridional (vertical) tendons anchored at the bottom of the basemat at elevation 666'-4" of which 60 "C" tendons stop at elevation 786'-6", 30 "B" tendons stop at elevation 815'-2 1/2" and the remaining 30 "A" tendons are anchored at elevation 821'-6" and elevation 841'-6".

Each tendon consists of ninety 1/4 inch nominal diameter ASTM A421 Type BA wires with a button-headed BBRV type anchorage.

The tendons were manufactured by Inryco Products, Illinois. Initial stressing of the tendons was completed during 1978 for the Unit 1 containment and during 1980 for the Unit 2 containment. The containment design is based on a 40 year minimum tendon stress of 141.7 ksi (626 kips force) for all the vertical tendons and 140.4 ksi (620 kips force) for all the hoop tendons. The stress levels correspond to the seated end of the tendons and were determined based on a predicted 40 year prestress loss of 15.64% from the design seating stress (168 ksi) for the vertical tendons and 16.40% for the hoop tendons.

In order to ensure that the actual prestress loss is within the value allowed in the design and to ensure continued performance of the post-tensioning system, periodic in-service inspections (ISI) are conducted as specified in the LSCS Technical Specifications.

3. DESCRIPTION OF CONTAINMENT ISI PROGRAM

The LaSalle containment structural integrity is ensured utilizing a periodic surveillance program which includes both scheduled containment post-tensioning system examinations and Integrated Leak Rate Tests (ILRT). The primary containment "limiting conditions for operation" are included in the LSCS Technical Specification Section 3.6.1.5, and the "surveillance requirements" for the primary containment tendons are included in Section 4.6.1.5. Both the Unit 1 and 2 technical specifications are included in Appendix A.

A post-tensioning tendon surveillance for each unit is carried out 1, 3 and 5 years after the Structural Integrity Test and thereafter every five years. Each surveillance consists of the following:

a. Lift-off of a sample of tendons to determine the existing force in the tendons. This lift-off force is compared to a predicted value which accounts for losses in force in the post-tensioning.

b. One hoop tendon and one vertical tendon are detensioned and one wire is removed from each. The wires are examined, and three samples of the wire are tested to determine its tensile properties per ASTM A421.

c. A visual examination of the containment concrete surfaces in the area around the post-tensioning anchorages is carried out to ensure there is no structural distress. The anchorage components, anchorheads, shims and bearing plates, are also examined.

d. The sheathing filler grease is examined and tested to ensure that the corrosion preventative system is adequately performing its function.

4. EVALUATION OF CURRENT ISI WIRE TEST RESULTS

All but two of the twelve wire test samples met the technical specification tensile strength requirement of 240 ksi. The results of the two samples with strengths less than 240 ksi indicated a tested tensile strength of 237.0 ksi for tendon V231C, end sample 2, and 239.5 ksi for tendon V22A, end sample 2. All samples meet or exceed the minimum specified tensile strength including the other samples from the same wires that had a low result. The ISI wire test results and the CMTR results for the tendons inspected in this surveillance are presented in Table 1. The ISI wire test results include three samples from each wire. The CMTR results include the results from each coil that was used to fabricate the tendon; e.g. tendon H4BA was fabricated from four coils of wire and samples were taken from both ends of each coil. The ISI test data summary and the CMTRs contain the measured diameter and the break force for the wire samples and are included in Appendix B.

For tendons H4BA and H23FE, the tested tensile strengths are acceptable and are consistent with the CMTR values. The wire elongation values are acceptable.

As seen from the CMTR data, both tendons V22A and V231C were made of wire with tensile strengths as low as 243.7 ksi for tendon V22A, and 240.9 ksi for tendon V231C. Considering the range in tensile strengths obtained from wire testing, the wire test results are consistent with the CMTR data for the tendons. The original CMTR testing was performed for each coil. The LaSalle coil test results meet the minimum tensile strength of 240 ksi. The test results fell at or above the required strength. The range of CMTR tensile strength results is presented in Table 2. The front to back variation in test results is important to understand the subject LaSalle surveillance wire test results. Front to back variation for a random sample of 62 coils from the LaSalle CMTRs showed a mean of 2.7 ksi. This same type of variation may exist along the length of the wire in the coil which is untested except during in-service inspections. ASTM A421 provides sufficient controls on wire diameter, wire strength, wire chemistry, and wire "buttonheadability" to assure that tendons can be fabricated and stressed to specified prestress forces.

The differences between the original CMTR testing and the ISI testing contribute to the apparent difference between the CMTR tensile strengths and ISI tensile strengths for the wires from tendons V22A and V231C. The location of the sample within a coil and frequency of tests along the wire is different for the CMTR tests than the ISI testing. An individual wire test during wire production follows the same procedure as used in wire testing during ISIs. However, the number of tests per unit weight of wire is much greater during the ISIs. The three ISI test specimens are taken from an individual wire, while the CMTR data is based on the front and back ends of an individual coil. The wire manufacturing process controls the wire diameter and stress relief sufficiently to obtain tolerable uniformity along the wire in a coil. But wire strength will vary slightly in any given location in the coil. A coil will weigh from 800 to 1200 lbs. and thirty six 200 foot wires can be made from a 1200 lb. coil.

The ISI test sample conditions also differ from the tests reported in the CMTRs. Handling of the wire during extraction from the tendon and shipping to the testing laboratory could effect the tensile strength. The results of wire tests are sensitive to sample length, rate of loading, wire bend (or wire out-of-straightness) and eccentricities which may be present in the test machine. Wire bend, short sample length, and machine eccentricity produce or amplify bending stresses and strains and will result in a lower tensile strength than the wire capability. Too high a test loading rate will break the wire before its capability is reached. The ISI wires actually tested had a bend greater than 2 inches in a 50 inch length which resulted from the coiling of the wire sample for shipment from the station to the laboratory. This bend corresponds to a permanent strain in the test sample of 0.001 inches/inch. This permanent strain will reduce the strain capability of the wire and will produce wire tensile strength and strain less than the wire would be capable of if it were straight. The original LaSalle Inryco specification for purchase of the wire required the wires to have a maximum 1 inch of bend in a 6 foot length.

All wire samples from the vertical tendons did break above the required force. The minimum specified break force corresponding to ASTM A421 1/4 inch diameter wire is 11,780 lbs. The minimum break force recorded during ISI testing is 11,850 lbs. for tendon V22A and 11,830 lbs. for tendon V231C, both of which exceed the minimum specified force requirement. Tendon design is based on the force being imposed by the post-tensioning system on the containment structure. Individual wires are counted on to supply a certain portion of the overall tendon force.

Testing of additional wires is not warranted. The wire test tensile strength results are consistent with the CMTR results when normal testing variation and test sample condition are considered. As stated, the lower strength as expressed in terms of stress is of no design consequence, and does not indicate any degradation of the post-tensioning system or loss of integrity of the containment.

5. CONTAINMENT TENDON SURVEILLANCE HISTORY

The current containment tendon surveillances are the fourth for Unit 1 and third for Unit 2 since the Structural Integrity Tests. The Structural Integrity Tests for Units 1 and 2 were performed in December 1978 and June 1983, respectively. The start dates of the surveillances are as follows:

Unit 1	Unit 2
June 1980	April 1984
April 1982	November 1986
November 1983	February 1988
February 1988	

All surveillances include 1) tendon lift-off tests, 2) visual inspection of tendons, anchorage components and concrete, 3) visual inspection and testing of casing filler grease, and 4) removal, inspection and testing of tendon wires. The past surveillances for both units have shown no

indication of any type of degradation of any of the post-tensioning system components.

Tendon lift-off forces from recent and past surveillances have been acceptable as shown in Table 3, where lift-off forces are compared with predicted forces. Tendon forces above the predicted values indicate that the prestress assumed in the containment design is available and that the design stresses calculated in the containment reinforcing steel and concrete meet the FSAR requirements. These tendon lift-off forces also indicate, when compared to the predicted values, that losses in the tendon stresses are occurring at a rate less than predicted which is indicative of acceptable prestress at the end of the plant 40 year life.

The visual examination of the tendon anchorages and the removed tendon wires during the past surveillances indicate no component degradation. Grease coverage on the system, and the condition of the anchorage components and removed wires have been acceptable. Grease chemistry results i.e., the quantity of water soluble chlorides, nitrates and sulfides, have been acceptable.

The wire tensile strength test data from the past surveillances are shown in Tables 4 and 5 for Unit 1 and 2, respectively. Also shown are the corresponding CMTR values for the various coils making up the tendon from which wires were removed. As seen from the ISI test results, all previous wire tests have been acceptable. The average tensile strength of all ISI wire test results to date is 249 ksi. Comparison of the ISI results with the CMTR results shows the same average tensile strength results which indicates that there is no strength degradation from the time the CMTR tests were performed. Comparison of CMTR results and ISI results does, however, indicate normal scatter which as discussed earlier, is attributable to variation along the wire and variation in the wire testing procedure.

Therefore, it can be concluded that no degradation has occurred in the post-tensioning system. The surveillance results indicate that the containments are in the same condition as they were when the Structural Integrity tests were performed.

6. DESIGN OF CONTAINMENT

The required level of containment integrity is available considering the wire test results from tendons V22A and V231C. The tendon lift-off forces from the recent and past surveillances are above the predicted forces as tabulated in Table 3 indicating the required prestress assumed in the containment design is available and that the minimum design stress margins for the reinforcing steel and concrete presented in the LSCS DAR Tables 5.1-1 through 5.1-14 are unchanged. The wire break force is above the required force, and therefore the tendon strength is greater than the nominal strength based on 240 ksi for 90-1/4 inch diameter wires. It also should be noted from Table 2 that the average CMTR tensile strength is 249 ksi resulting in additional margin in the tendon strength.

The ultimate internal pressure capacity of the containment is more than 3 times the design accident pressure of 45 psig and is limited by the personnel airlock bulkhead assembly. The capacity of the containment pressure boundary backed by concrete is more than 4.5 times the design pressure and will not be affected by the recent wire test results, since the break forces for all the wire samples exceeded the minimum break force requirement.

7. CONCLUSION

The LaSalle containments meet all FSAR design and technical specification requirements. There has been no change in the containment condition because:

a. Minimum specified ultimate force required for breaking the individual wires was met.

b. The two lower strength test results are understandable based on original material test and normal variation along a wire, and variation in test procedures.

c. Visual and lift-off results indicate that the containment prestressing system is performing as required.

d. Average ISI wire test results over the life of both units exceed the minimum specified strength by a significant margin.

e. The design and ultimate strength of the containment is not affected by these results.

Table 1

CURRENT YEAR (1988) SURVEILLANCE UNITS 1 & 2

TENSILE PROPERTIES

		ISI WIRE TEST RESULTS			CMTR RESULTS		
ISI YEAR	TENDON	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.
1988	H4BA	End 1	250.5	5.69	F1	246.9	≥ 4.0
10th yr.		Mid	248.0	4.82	B1	249.7	≥ 4.0
Unit 1		End 2	256.5	5.20	F2	240.4	≥ 4.0
					B2	253.8	≥ 4.0
					F3	247.3	≥ 4.0
					B3	248.5	≥ 4.0
					F4	240.9	5.3
					B4	248.9	5.3
1988	H23FE	End 1	247.5	4.22	F1	244.0	5.0
5th yr.		End 2	247.5	4.03	B1	248.1	5.0
Unit 2		Mid	248.5	4.28	F2	250.1	≥ 4.0
					B2	252.6	≥ 4.0
					F3	249.7	≥ 4.0
					B3	257.9	≥ 4.0
					F4	249.7	5.0
					B4	253.4	5.0
1988	V22A	End 2	239.5	4.03	F1	248.5	≥ 4.0
10th yr.		Mid	242.0	4.52	B1	243.7	≥ 4.0
Unit 1		End 1	240.5	5.27	F2	244.9	≥ 4.0
					B2	243.7	≥ 4.0
1988	V231C	End 1	240.5	4.77	F1	246.5	≥ 4.0
5th yr.		Mid	240.0	5.50	B1	250.6	≥ 4.0
Unit 2		End 2	237.0	4.45	F2	246.9	≥ 4.0
					B2	246.9	≥ 4.0
					F3	240.9	5.3
					B3	241.3	5.3

Note: F1, F2, ... = Front
B1, B2, ... = Back

Table 2

STATISTICAL EVALUATION OF TENDON WIRE TENSILE PROPERTIES

PROPERTY	MAXIMUM	MINIMUM	MEAN	STD. DEVIATION
Tensile strength (ksi)	263.5	240.0	249.73	5.21
%Elongation	6.6	4.0	5.10	0.62

Number of samples = 341

Table 3

LASALLE UNITS 1 & 2

Comparison of Measured vs. Predicted Tendon Forces

Tendon Mark	Lift-off (Kips) Measured	Predicted	
1st yr, Unit 1			
H1CB	693.8	643.7	
H12AC	675.0	643.7	
H12CB	693.8	643.7	
H20CB	652.5	643.7	
H21AC	671.3	643.7	
H48AC	697.4	643.7	
H56BA	680.8	643.7	
H56CB	708.8	643.7	
H70B	697.5	643.7	
V15A	690.0	651.7	
V15C	690.0	651.7	
V20A	690.0	651.7	
V29A	678.8	651.7	
V47C	690.0	651.7	
3rd yr, Unit 1			
H2CB	661.5	648.0	
H14AC	654.0	621.0	
H24BA	665.5	629.0	
H37CB	657.5	626.0	
H47CB	672.5	640.0	
H48AC	676.5	641.0	
H57CB	702.5	643.0	
H60B	684.0	640.0	
V6C	683.0	649.0	
V15C	690.0	649.0	
V17A	675.0	645.0	
V32C	683.0	649.0	
V42C	675.0	649.0	
5th yr, Unit 1			
H3BA	676.5	647.6	
H12BA	650.1	624.5	
H21CB	642.7	624.5	
H23BA	627.6	616.7	
H38CB	642.6	620.3	
H48AC	668.8	637.5	
H49AC	657.7	630.4	
H68B	657.7	646.3	
V5B	673.0	644.3	
V15C	676.8	645.7	
V23A	665.5	641.5	
V27A	688.2	641.5	Adjacent tendon
V28A	627.7	641.5 #	2 % lower than predicted
V29A	657.9	641.5	Adjacent tendon
V31C	673.0	642.7	
10th yr, Unit 1			
H4BA	642.8	638.1	
H41CB	675.5	629.2	
H48AC	678.5	633.1	
H50AC	667.2	636.5	
V15C	647.6	641.5	
V22A	666.2	637.4	
V30B	651.3	640.1	

These tendon lift-off ...

Table 3 (Cont'd)
LASALLE UNITS 1 & 2
Comparison of Measured vs. Predicted Tendon Forces

Tendon Mark	Lift-off (Kips) Measured	Lift-off (Kips) Predicted		
1st yr, Unit 2				
H1GF	676.9	645.5		
H12EG	635.4	629.3		
H12GF	639.3	629.3		
H20GF	650.5	621.5		
H48EG	665.6	641.0		
H56GF	648.6	639.3		
H56FE	646.7	639.3		
H70F	665.6	643.8		
V214A	666.6	644.9		Adjacent tendon
V215A	636.7	644.9	#	1 % lower than predicted
V215C	662.9	649.1		
V216A	666.6	637.7		Adjacent tendon
V220A	655.4	644.9		
V229A	644.2	644.9		
V247C	666.6	641.9		
3rd yr, Unit 2				
H2GF	674.8	644.9		
H14EG	618.2	616.7		
H24FE	626.2	624.5		
H37GF	648.1	614.7		
H46GF	629.8	629.4		Adjacent tendon
H47GF	630.9	635.9	#	.8 % lower than predicted
H48GF	648.6	644.2		Adjacent tendon
H48EG	659.7	637.5		
H57GF	633.5	625.4		
H60F	638.4	636.5		
V206C	646.2	645.7		
V215C	649.2	645.7		
V217A	646.2	641.5		
V232C	659.2	645.7		
V242C	653.7	645.7		
5th yr, Unit 2				
H3FE	649.6	645.2		
H12FE	633.4	621.1		
H21GF	650.3	621.1		
H23[illegible]	640.9	613.3		
H38[illegible]	664.2	624.4		
H48[illegible]	662.4	635.0		
H49[illegible]	665.4	635.0		
H68F	658.9	643.9		
V205B	N/A *	641.9		* Lift-off scheduled for October
V215C	651.3	643.3		
V223A	666.4	639.1		
V228A	651.3	639.2		
V231C	658.8	643.3		

Table 4
UNIT 1 SURVEILLANCE HISTORY
TENSILE PROPERTIES

		ISI WIRE TEST RESULTS			CMTR RESULTS		
ISI YEAR	TENDON	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.
1980 1st yr.	H20CB	B	258.7	4.5	F1	251.4	≥ 4.0
		M	258.7	4.8	B1	255.4	≥ 4.0
		C	259.7	5.2	F2	251.4	≥ 4.0
					B2	251.0	≥ 4.0
					F3	249.7	≥ 4.0
					B3	248.5	≥ 4.0
	V47C	B	251.6	6.3	F1	245.3	≥ 4.0
		M	250.6	6.3	B1	242.8	≥ 4.0
		C	244.6	5.1	F2	246.1	≥ 4.0
					B2	242.8	≥ 4.0
1982 3rd yr.	H2CB	B	257.2	≥ 4.0	F1	248.9	≥ 4.0
		M	255.1	≥ 4.0	B1	254.2	≥ 4.0
		C	257.1	≥ 4.0	F2	252.6	5.7
					B2	256.6	5.7
					F3	250.1	≥ 4.0
					B3	253.8	≥ 4.0
					F4	241.3	≥ 4.0
					B4	246.9	≥ 4.0
	V42C	B	249.6	≥ 4.0	F1	242.9	≥ 4.0
		M	248.6	≥ 4.0	B1	241.7	≥ 4.0
		C	246.0	≥ 4.0	F2	242.4	≥ 4.0
					B2	243.6	≥ 4.0
1983/84 5th yr.	H23BA	B	256.2	≥ 4.0	F1	249.3	≥ 4.0
		M	256.7	≥ 4.0	B1	248.1	≥ 4.0
		C	256.7	≥ 4.0	F2	249.7	≥ 4.0
					B2	249.3	≥ 4.0
					F3	251.4	≥ 4.0
					B3	249.3	≥ 4.0
	V31C	B	246.6	≥ 4.0	F1	243.3	5.4
		M	247.6	≥ 4.0	B1	248.9	5.4
		C	247.6	≥ 4.0	F2	242.9	≥ 4.0
					B2	243.3	≥ 4.0

Note: B = Button end
M = Middle
C = Cut end

F1, F2, ... = Front
B1, B2, ... = Back

Table 5
UNIT 2 SURVEILLANCE HISTORY
TENSILE PROPERTIES

		ISI WIRE TEST RESULTS			CMTR RESULTS		
ISI YEAR	TENDON	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.	SAMPLE I.D.	STRENGTH (KSI)	% ELONG.
1984 1st yr.	H20GF	L1	250.0	5.0	F1	246.5	≥ 4.0
		L2	253.0	5.0	B1	248.9	≥ 4.0
		L3	252.2	4.5	F2	248.5	4.5
		M	250.2	5.0	B2	255.0	4.5
		R	250.2	4.5	F3	247.3	≥ 4.0
					B3	245.0	≥ 4.0
	V247C	L	240.5	5.0	F1	240.4	≥ 4.0
		M	246.1	4.5	B1	244.9	≥ 4.0
		R	240.5	5.0	F2	241.7	≥ 4.0
					B2	242.1	≥ 4.0
1986 3rd yr.	H2GF	L	255.0	≥ 4.0	F1	252.6	5.5
		M	251.7	≥ 4.0	B1	250.6	5.5
		R	249.8	≥ 4.0	F2	255.0	≥ 4.0
					B2	251.4	≥ 4.0
					F3	255.0	≥ 4.0
					B3	254.6	≥ 4.0
					F4	247.7	≥ 4.0
					B4	244.5	≥ 4.0
	V242C	L	244.0	≥ 4.0	F1	246.9	≥ 4.0
		M	246.3	≥ 4.0	B1	247.3	≥ 4.0
		R	242.3	≥ 4.0	F2	249.7	≥ 4.0
					B2	254.6	≥ 4.0

Overall average of wire test strenghts from all (14) tendons from Tables 1, 4, & 5 = 249 ksi

Note: L, L1, ... = Left end; M = Middle; C = Cut end; F1, F2, ... = Front; B1, B2, ... = Back

FIGURE 1

CONTAINMENT STRUCTURE

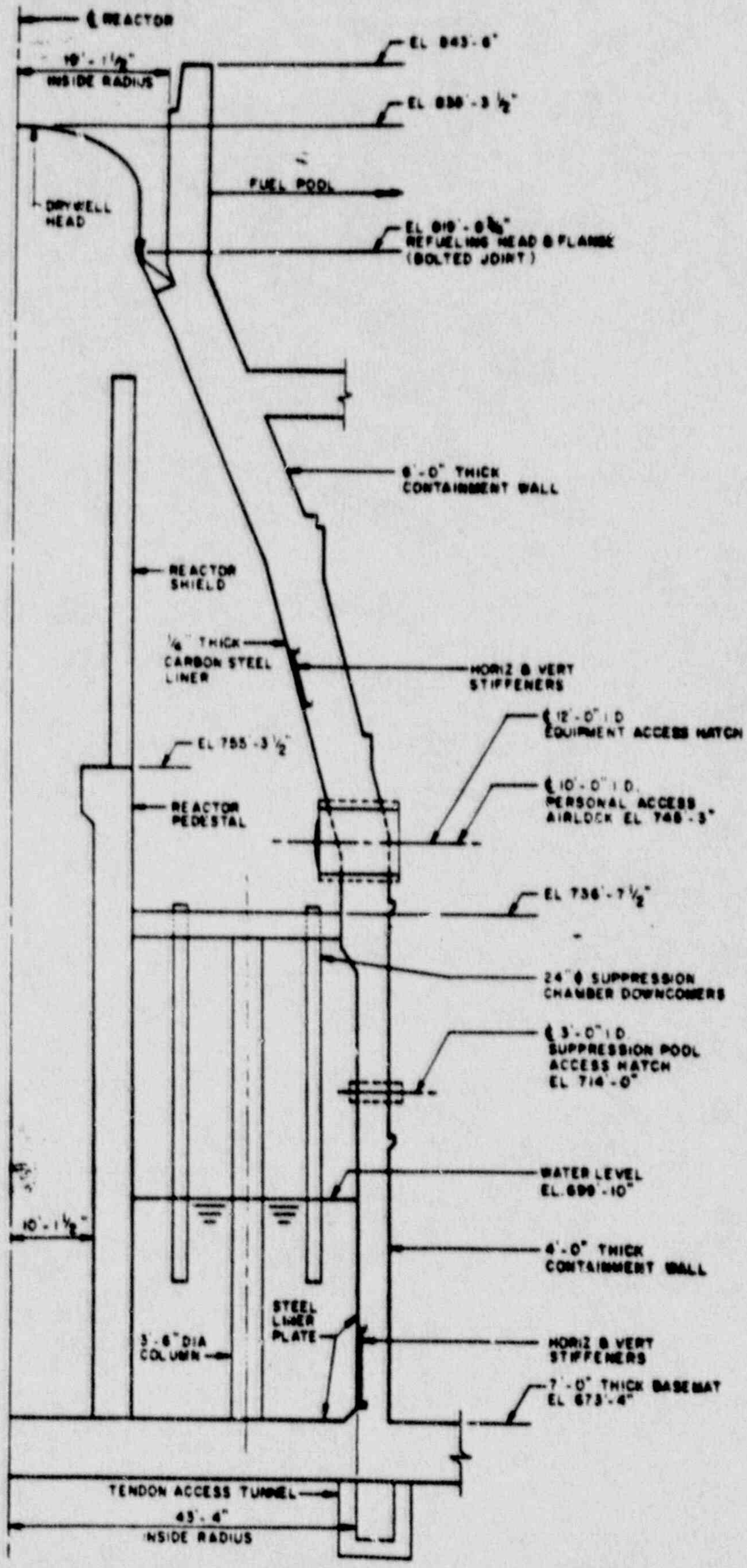
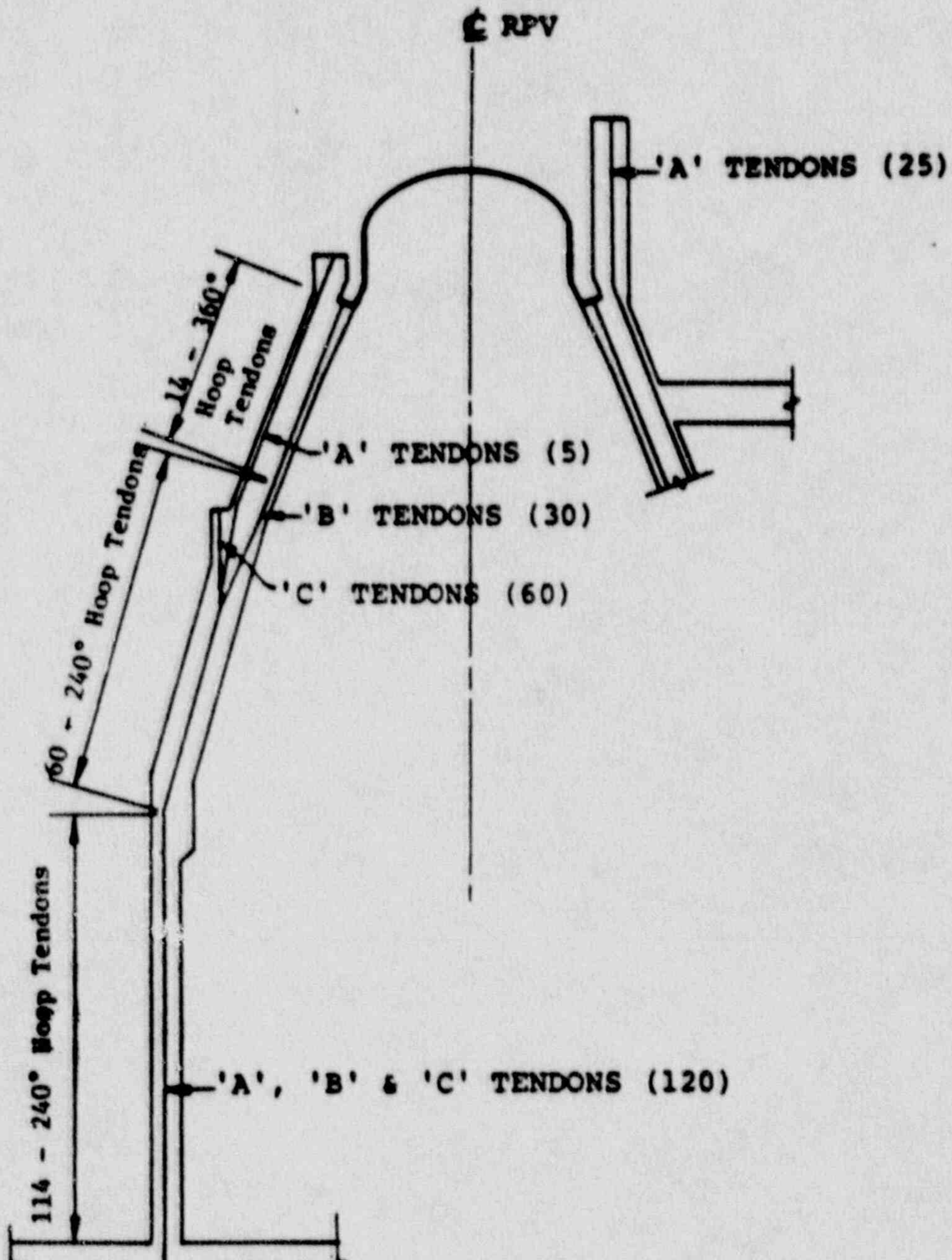


FIGURE 2

TYPICAL LAYOUT OF
POST-TENSIONING TENDONS



APPENDIX A

LaSalle Station
Tech. Specs. Unit 1

PRIMARY CONTAINMENT STRUCTURAL INTEGRITY

LIMITING CONDITION FOR OPERATION

3.6.1.5 The structural integrity of the primary containment shall be maintained at a level consistent with the acceptance criteria in Specification 4.6.1.5.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 3.

ACTION:

a. With more than one tendon with an obseved lift-off force between the predicted lower limit and 90% of the predicted lower limit or with one tendon below 90% of the predicted lower limit, restore the tendon(s) tothe required level of integrity within 15 days and perform an engineering evaluation of the containment and provide a Special Report to the Commission within 30 days in accordance with Specification 6.6C. or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With any other abnormal degradation of the structural integrity at a level below the acceptance criteria of Specification 4.6.1.5, restore the containment vessel to the required level of integrity within 72 hours and perform an engineering evaluation of the containment and provide a Special Report to the Commission within 15 days in accordance with Specification 6.6C. or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.5 Primary Containment Tendons. The primary containment structural integrity shall be demonstrated at the end of 1, 3 and 5 years after the initial structural integrity test (ISIT) and every 5 years thereafter in accordance with Table 4.6.1.5-1. The structural integrity shall be demonstrated by:

a. Determining that a representative sample of at least 13 tendons, 8 horizontal and 5 vertical, selected in accordance with Table 4.6.1.5-1 have a lift-off force equal to or greater than the minimum values listed in Table 4.6.1.5-2 at the first year inspection. For subsequent inspections, for tendons and periodicities per Table 4.6.1.5-1, the minimum lift-off forces shall be decreased by the amount X2 log $t/_{to}$ for V tendons and Y2 log $t/_{to}$ for hoop tendons where t is the time interval in years from initial tensioning of the tendon to the current testing date and to is the time interval in years from initial tensioning of the tendon to the first inspection and is equal to 2 years and the values X1, X2, Y1 and Y2 are in accordance with the values listed in Table 4.6.1.5-2 for the surveillance tendon. This test shall include essentially a complete detensioning of tendons selected in accordance with Table 4.6.1.5-1 in which the tendon is detensioned to determine if any wires or strands are broken or damaged. Tendons found acceptable during this test shall be retensioned to their observed lift-off force, ± 3%. During retensioning of these tendons, the change in load and elongation shall be measured simultaneously at a minimum of three, approximately equally spaced, levels of force between the seating force and zero. If elongation corresponding to a specific load differs by more than 5% from that recorded during installation of tendons, an investigation should be made to ensure that such difference is not related to wire failures or slip of wires in anchorages. If the lift-off force of any one tendon in the total sample population lies between the predicted lower limit and 90% of the predicted lower limit, two tendons, one on each side of this tendon, shall be checked for their lift-off force. If both these adjacent tendons are found acceptable, the surveillance program may proceed considering the single deficiency as unique and acceptable. The tendon(s) shall be restored to the required level of integrity. More than one tendon below the predicted bounds out of the original sample population or the lift-off force of a selected tendon lying below 90% of the prescribed lower limit is evidence of abnormal degradation of the containment structure.

b. Performing tendon detensioning and material tests and inspections of a previously stressed tendon wire or strand from one tendon of each group, hoop and V, and determining that over the entire length of the removed wire or strand that:

   1. The tendon wires or strands are free of corrosion, cracks and damage.

   2. A minimum tensile strength value of 240 ksi, the guaranteed ultimate strength of the tendon material, for at least three wire or strand samples, one from each end and one at mid-length, cut from each removed wire or strand. Failure of any one of the wire or strand samples to meet the minimum tensile strength test is evidence of abnormal degradation of the primary containment structure.

SURVEILLANCE REQUIREMENTS (Continued)

c. Performing a visual inspection of the following:

1. Primary Containment Surfaces - The structural integrity of the exposed accessible interior and exterior surfaces of the primary containment shall be determined during the shutdown for, and prior to, each Type A containment leakage rate test by a visual inspection of these surfaces and verifying no apparent changes in appearance or other abnormal degradation, e.g., widespread cracking, spalling and/or grease leakage.

2. End Anchorages - The structural integrity of the end anchorages, e.g., bearing plates, stressing washers, shims, wedges and anchorheads, of all tendons inspected pursuant to Specification 4.6.1.5a shall be demonstrated by inspection that no apparent changes have occurred in the visual appearance of the end anchorage.

3. Concrete Surfaces - The structural integrity of the concrete surface adjacent to the anchorages of tendons inspected pursuant to Specification 4.6.1.5a shall be demonstrated by visual examination of the crack patterns to verify no abnormal material behavior.

d. Verifying the OPERABILITY of the sheathing filler grease by the following:

1. No significant voids, i.e., in excess at 5% of the net duct volume, or the presence of free water within the grease filler material, taking into account temperature variations.

2. No significant changes have occurred in the physical appearance of the sheathing filler grease.

3. Minimum grease coverage exists for different parts of the anchorage system.

4. Chemical properties are within the tolerance limits specified by the sheathing filler grease manufacturer.

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TABLE 4.6.1.5-1

TENDON SURVEILLANCE

Years After Initial Structural Integrity Test	1		3		5		10		15	
	TENDON NUMBERS									
Type of Inspection	H	V	H	V	H	V	H	V	H	V
Visual Inspection of End Anchorages Adjacent Concrete Surface and Prestress Monitoring Tests	48AC 56CB 12CB 70B 20CB 1CB 12AC 56BA 21AC	15C 15A 20A 47C 29A	48AC 2CB 14AC 24BA 37CB 47CB 57CB 60B	15C 6C 17A 32C 42C	48AC 3BA 12BA 21CB 23BA 38CB 49AC 68B	15C 28A 23A 5B 31C	48AC 4BA 41CB 50AC	15C 30B 22A	48AC 50CB 53BA 57AC	15C 19A 13B
Detensioning and Material Tests	20CB	47C	2CB	42C	23BA	31C	4BA	22A	50CB	19A

Years After Initial Structural Integrity Test	20		25		30		35		40	
	TENDON NUMBERS									
Type of Inspection	H	V	H	V	H	V	H	V	H	V
Visual Inspection of End Anchorages Adjacent Concrete Surface and Prestress Monitoring Tests	48AC 39CB 49BA 71D	15C 25B 11A	48AC 1BA 47AC 57BA	15C 3B 12A	48AC 48CB 51AC 58BA	15C 7B 18A	48AC [illegible] 51BA 59D	15C 25A 18B	48AC 36CB 48BA 69D	15C 13A 27B
Detensioning and Material Tests	49BA	11A	47AC	3B	48CB	18A	51BA	18B	36CB	13A

TABLE 4.6.1.6-2

TENDON LIFT-OFF FORCE

V TENDONS

Tendon Number	Ends	First Year[a] Maximum (kips)	First Year[a] Minimum (kips)	X1	X2
V15C	A	N/A	654.95	N/A	4.369
	B	N/A	N/A	N/A	N/A
V20A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V23A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V5B	A	N/A	653.27	N/A	4.270
	B	N/A	N/A	N/A	N/A
V31C	A	N/A	651.90	N/A	4.369
	B	N/A	N/A	N/A	N/A
V30B	A	N/A	655.74	N/A	4.270
	B	N/A	N/A	N/A	N/A
V22A	A	N/A	655.74	N/A	4.270
	B	N/A	N/A	N/A	N/A
V19A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V13B	A	N/A	653.27	N/A	4.270
	B	N/A	N/A	N/A	N/A
V25B	A	N/A	653.23	N/A	4.263
	B	N/A	N/A	N/A	N/A
V11A	A	N/A	650.49	N/A	4.263
	B	N/A	N/A	N/A	N/A
V3B	A	N/A	653.27	N/A	4.270
	B	N/A	N/A	N/A	N/A
V12A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V7B	A	N/A	653.27	N/A	4.270
	B	N/A	N/A	N/A	N/A
V16A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V25A	A	N/A	650.53	N/A	4.270
	B	N/A	N/A	N/A	N/A
V18B	A	N/A	653.27	N/A	4.270
	B	N/A	N/A	N/A	N/A
V13A	A	N/A	643.28	N/A	4.263
	B	N/A	N/A	N/A	N/A
V27B	A	N/A	653.23	N/A	4.263
	B	N/A	N/A	N/A	N/A

[a]First Inspection

Table 4.6.1.5-2 (Continued)

TENDON LIFT-OFF FORCE

HOOP TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	Y1	Y2
48AC	A	N/A	647.00	N/A	4.500
	B	N/A	647.00	N/A	4.500
3BA	A	N/A	656.46	N/A	4.226
	B	N/A	656.46	N/A	4.226
12BA	A	N/A	637.48	N/A	6.173
	B	N/A	637.48	N/A	6.173
21CB	A	N/A	637.48	N/A	6.173
	B	N/A	637.48	N/A	6.173
23BA	A	N/A	629.71	N/A	6.173
	B	N/A	629.71	N/A	6.173
38CB	A	N/A	631.76	N/A	[illegible]
	B	N/A	631.76	N/A	[illegible]
49AC	A	N/A	647.00	N/A	[illegible]
	B	N/A	647.00	N/A	[illegible]
6BB	A	N/A	655.39	N/A	4.332
	B	N/A	655.39	N/A	4.332
4BA	A	N/A	651.16	N/A	4.226
	B	N/A	651.16	N/A	4.226
41CB	A	N/A	644.51	N/A	4.975
	B	N/A	644.51	N/A	4.975
[illegible]	A	N/A	650.35	N/A	4.500
	B	N/A	650.35	N/A	4.500
50CB	A	N/A	650.35	N/A	4.500
	B	N/A	650.35	N/A	4.500
53BA	A	N/A	649.82	N/A	4.538
	B	N/A	649.82	N/A	4.538
57AC	A	N/A	650.14	N/A	4.862
	B	N/A	650.14	N/A	4.862
39CB	A	N/A	644.69	N/A	5.437
	B	N/A	644.69	N/A	5.437
49BA	A	N/A	647.00	N/A	4.500
	B	N/A	647.00	N/A	4.500
71D	A	N/A	645.20	N/A	4.332
	B	N/A	645.20	N/A	4.332
1BA	A	N/A	655.82	N/A	3.914
	B	N/A	655.82	N/A	3.914
47AC	A	N/A	644.51	N/A	4.975
	B	N/A	644.51	N/A	4.975
57BA	A	N/A	650.18	N/A	4.862
	B	N/A	650.18	N/A	4.862
48CB	A	N/A	646.48	N/A	4.507
	B	N/A	646.48	N/A	4.507
51AC	A	N/A	653.75	N/A	4.507
	B	N/A	653.75	N/A	4.507

*First Inspection

Table 4.6.1.5-2 (Continued)

TENDON LIFT-OFF FORCE
HOOP TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	Y1	Y2
58BA	A	N/A	640.84	N/A	4.912
	B	N/A	640.84	N/A	4.912
49CB	A	N/A	639.80	N/A	4.500
	B	N/A	639.80	N/A	4.500
51BA	A	N/A	653.76	N/A	4.500
	B	N/A	653.76	N/A	4.500
59D	A	N/A	638.18	N/A	4.906
	B	N/A	638.18	N/A	4.906
36CB	A	N/A	644.69	N/A	5.437
	B	N/A	644.69	N/A	5.437
48BA	A	N/A	653.76	N/A	4.500
	B	N/A	653.76	N/A	4.500
69D	A	N/A	642.31	N/A	4.332
	B	N/A	642.31	N/A	4.332

*First Inspection

[illegible] Station
Tech. Specs. UNit 2

PRIMARY CONTAINMENT STRUCTURAL INTEGRITY

LIMITING CONDITION FOR OPERATION

3.6.1.5 The structural integrity of the primary containment shall be maintained at a level consistent with the acceptance criteria in Specification 4.6.1.5.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 3.

ACTION:

a. With more than one tendon with an observed lift-off force between the predicted lower limit and 90% of the predicted lower limit or with one tendon below 90% of the predicted lower limit, restore the tendon(s) to the required level of integrity within 15 days and perform an engineering evaluation of the containment and provide a Special Report to the Commission within 30 days in accordance with Specifica[illegible].6C. or be in at least HOT STANDBY within the next 6 hours a[illegible] COLD SHUTDOWN within the following 30 hours.

b. With any other abnormal degradation of the structural integrity at a level below the acceptance criteria of Specification 4.6.1.5, restore the containment vessel to the required level of integrity within 72 hours and perform an engineering evaluation of the containment and provide a Special Report to the Commission within 15 days in accordance with Specification 6.6C. or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.5 Primary Containment Tendons. The primary containment structural integrity shall be demonstrated at the end of 1, 3, and 5 years after the initial structural integrity test (ISIT) and every 5 years thereafter in accordance with Table 4.6.1.5-1. The structural integrity shall be demonstrated by:

a. Determining that a representative sample of at least 13 tendons, 8 horizontal and 5 vertical, selected in accordance with Table 4.6.1.5-1 have a lift-off force equal to or greater than the minimum values listed in Table 4.6.1.5-2 at the first inspection. For subsequent inspections, for tendons and periodicities per Table 4.6.1.5-1, the minimum lift-off forces shall be decreased by the amount X2 log t/t_o for V tendons and Y2 log t/t_o for hoop tendons where t is the time interval in years from initial tensioning of the tendon to the current testing date and t_o is the time interval in years from initial tensioning of the tendon to the first inspection and is equal to 4 years. The values X1, X2, Y1, and Y2 are in accordance with the values listed in Table 4.6.1.5-2 for the surveillance tendon. This test shall include essentially a

SURVEILLANCE REQUIREMENTS (Continued)

complete detensioning of tandons selected in accordance with Table 4.6.1.5-1 in which the tendon is detensioned to determine if any wires or strands are broken or damaged. Tendons found acceptable during this test shall be retensioned to their observed lift-off force, ± 2%. During retensioning of these tendons, the change in load and elongation shall be measured simultaneously at a minimum of three, approximately equally spaced, levels of force between the seating force and zero. If elongation corresponding to a specific load differs by more than 5% from that recorded during installation of tandons, an investigation should be made to ensure that such difference is not related to wire failures or slip of wires in anchorages. If the lift-off force of any one tendon in the total sample population lies between the predicted lower limit and 90% of the predicted lower limit, two tendons, one on each side of this tendon, shall be checked for their lift-off force. If both these adjacent tendons are found acceptable, the surveillance program may proceed considering the single deficiency as unique and acceptable. The tendon(s) shall be restored to the required level of integrity. More than one tendon below the predicted bounds out of the original sample population or the lift-off force of a selected tendon lying below 90% of the prescribed lower limit is evidence of abnormal degradation of the containment structure.

b. Performing tendon detensioning and material tests and inspections of a previously stressed tendon wire or strand from one tendon of each group, hoop and V, and determining that over the entire length of the removed wire or strand that:

   1. The tendon wires or strands are free of corrosion, cracks and damage.

   2. A minimum tensile strength value of 240 ksi, the guaranteed ultimate strength of the tendon material, for at least three wire or strand samples, one from each end and one at mid-length, cut from each removed wire or strand. Failure of any one of the wire or strand samples to meet the minimum tensile strength test is evidence of abnormal degradation of the primary containment structure.

c. Performing a visual inspection of the following:

   1. Primary Containment Surfaces - The structural integrity of the exposed accessible interior and exterior surfaces of the primary containment shall be determined during the shutdown for, and prior to, each Type A containment leakage rate test by a visual inspection of these surfaces and verifying no apparent changes in appearance or other abnormal degradation, e.g., widespread cracking, spalling, and/or grease leakage.

2. End Anchorages - The structural integrity of the end anchorages, e.g., bearing plates, stressing washers, shims, wedges, and anchorheads, of all tendons inspected pursuant to Specification 4.6.1.5a. shall be demonstrated by inspection that no apparent changes have occurred in the visual appearance of the end anchorage.

3. Concrete Surfaces - The structural integrity of the concrete surfaces adjacent to the anchorages of tendons inspected pursuant to Specification 4.6.1.5a. shall be demonstrated by visual examination of the crack patterns to verify no abnormal material behavior.

d. Verifying the OPERABILITY of the sheathing filler grease by the following:

1. No significant voids, i.e., in excess at 5% of the net duct volume, or the presence of free water within the grease filler material, taking into account temperature variations.

2. No significant changes have occurred in the physical appearance of the sheathing filler grease.

3. Minimum grease coverage exists for different parts of the anchorage system.

4. Chemical properties are within the tolerance limits specified by the sheathing filler grease manufacturer.

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TABLE 4.6.1.5-1

TENDON SURVEILLANCE

	TENDON NUMBERS									
Years After Initial Structural Integrity Test	1		3		5		10		15	
Type of Inspection	H	V	H	V	H	V	H	V	H	V
Visual Inspection of End Anchorages Adjacent Concentrate Surface and Pre-stress Monitor-ing Tests	48EG 56GF 12GF 70F 20GF 1GF 12EG 56FE	215C 215A 220A 247C 229A	48EG 2GF 14EG 37GF 47GF 57GF 60F 24FE	215C 206C 217A 242C 232C	48EG 3FE 12FE 21GF 23FE 38GF 49EG 68F	215C 228A 223A 205B 231C	48EG 4FE 41GF 50EG	215C 230B 222A	48EG 50GF 53FE 57EG	215C 219A 213B
Detensioning and Material Tests	20GF	247C	2GF	242C	23FE	231C	4FE	222A	50GF	219A

	TENDON NUMBERS									
Years After Initial Structural Integrity Test	20		25		30		35		40	
Type of Inspection	H	V	H	V	H	V	H	V	H	V
Type of Inspection of End Anchorages Adjacent Concrete Surface and Pre-stress Monitor-ing Tests	48EG 39GF 49FE 71J	215C 225B 211A	48EG 1FE 47EG 57FE	215C 203B 212A	48EG 48GF 51EG 58FE	215C 207B 218A	48EG 49GF 51FE 59J	215C 225A 218B	48EG 36GF 48FE 69J	215C 213A 227B
Detensioning and Material Tests	49FE	211A	47EG	203B	48GF	218A	51FE	218B	36GF	213A

TABLE 4.6.1.5-2

TENDON LIFT-OFF FORCE
V TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	X1	X2
V215C	A	N.A.	649.14	N.A.	19.302
	B	N.A.	N.A.	N.A.	N.A.
V215A	A	N.A.	644.35	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V220A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V247C	A	N.A.	641.94	N.A.	19.088
	B	N.A.	N.A.	N.A.	N.A.
V229A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V206C	A	N.A.	649.14	N.A.	19.302
	B	N.A.	N.A.	N.A.	N.A.
V217A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V232C	A	N.A.	649.14	N.A.	19.302
	B	N.A.	N.A.	N.A.	N.A.
V242C	A	N.A.	649.14	N.A.	19.032
	B	N.A.	N.A.	N.A.	N.A.
V228A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V223A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V205B	A	N.A.	647.59	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V231C	A	N.A.	649.14	N.A.	19.302
	B	N.A.	N.A.	N.A.	N.A.
V230B	A	N.A.	647.59	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V222A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V219A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V213B	A	N.A.	647.60	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V225B	A	N.A.	640.38	N.A.	18.625
	B	N.A.	N.A.	N.A.	N.A.
V211A	A	N.A.	644.82	N.A.	18.834
	B	N.A.	N.A.	N.A.	N.A.
V203B	A	N.A.	640.41	N.A.	18.656
	B	N.A.	N.A.	N.A.	N.A.

*First Inspection

TABLE 4.6.1.5-2 (Continued)

TENDON LIFT-OFF FORCE

V TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	X1	X2
V207B	A	N.A.	647.59	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V218A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V225A	A	N.A.	644.85	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V218B	A	N.A.	647.59	N.A.	18.865
	B	N.A.	N.A.	N.A.	N.A.
V213A	A	N.A.	644.82	N.A.	18.8[illegible]
	B	N.A.	N.A.	N.A.	N.A.
V227B	A	N.A.	647.56	N.A.	18.83[illegible]
	B	N.A.	N.A.	N.A.	N.A.
V212A	A	N.A.	637.70	N.A.	18.656
	B	N.A.	N.A.	N.A.	N.A.

*First Inspection

TABLE 4.6.1.5-2 (Continued)

TENDON LIFT-OFF FORCE
HOOP TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	Y1	Y2
48EG	A	N.A.	641.01	N.A.	19.881
	B	N.A.	641.01	N.A.	19.881
56GF	A	N.A.	639.34	N.A.	21.480
	B	N.A.	639.34	N.A.	21.480
12GF	A	N.A.	629.27	N.A.	27.272
	B	N.A.	629.27	N.A.	27.272
7GF	A	N.A.	643.76	N.A.	19.139
	B	N.A.	643.76	N.A.	19.139
20GF	A	N.A.	621.50	N.A.	27.272
	B	N.A.	621.50	N.A.	27.272
1GF	A	N.A.	645.94	N.A.	18.670
	B	N.A.	645.94	N.A.	18.670
12EG	A	N.A.	629.27	N.A.	27.272
	B	N.A.	629.27	N.A.	27.272
56FE	A	N.A.	639.34	N.A.	21.480
	B	N.A.	639.34	N.A.	21.480
2GF	A	N.A.	648.19	N.A.	18.670
	B	N.A.	648.19	N.A.	18.670
14EG	A	N.A.	621.50	N.A.	27.272
	B	N.A.	621.50	N.A.	27.272
24FE	A	N.A.	629.27	N.A.	27.272
	B	N.A.	629.27	N.A.	27.272
37GF	A	N.A.	618.86	N.A.	23.754
	B	N.A.	618.86	N.A.	23.754
47GF	A	N.A.	639.75	N.A.	21.980
	B	N.A.	639.75	N.A.	21.980
57GF	A	N.A.	636.15	N.A.	21.434
	B	N.A.	636.15	N.A.	21.434
6GF	A	N.A.	640.20	N.A.	21.233
	B	N.A.	640.20	N.A.	21.233
3FE	A	N.A.	650.84	N.A.	18.670
	B	N.A.	650.84	N.A.	18.670
12FE	A	N.A.	629.27	N.A.	27.272
	B	N.A.	629.27	N.A.	27.272
21GF	A	N.A.	629.27	N.A.	27.272
	B	N.A.	629.27	N.A.	27.272
23FE	A	N.A.	621.50	N.A.	27.272
	B	N.A.	621.50	N.A.	27.272
38GF	A	N.A.	631.63	N.A.	24.021
	B	N.A.	631.63	N.A.	24.021
49EG	A	N.A.	641.01	N.A.	19.881
	B	N.A.	641.01	N.A.	19.881

*First Inspection

TABLE 4.6.1.5-2 (Continued)

TENDON LIFT-OFF FORCE

HOOP TENDONS

Tendon Number	Ends	First Year* Maximum (kips)	First Year* Minimum (kips)	Y1	Y2
66F	A	N.A.	642.43	N.A.	18.927
	B	N.A.	642.43	N.A.	18.927
4FE	A	N.A.	645.54	N.A.	18.670
	B	N.A.	645.54	N.A.	18.670
41GF	A	N.A.	637.89	N.A.	21.979
	B	N.A.	637.89	N.A.	21.979
50EG	A	N.A.	644.37	N.A.	19.881
	B	N.A.	644.37	N.A.	[illegible]
50GF	A	N.A.	644.37	N.A.	[illegible]
	B	N.A.	644.37	N.A.	[illegible]
53FE	A	N.A.	643.78	N.A.	[illegible]
	B	N.A.	643.78	N.A.	20.[illegible]
57EG	A	N.A.	643.67	N.A.	21.480
	B	N.A.	643.67	N.A.	21.480
39GF	A	N.A.	637.46	N.A.	24.021
	B	N.A.	637.46	N.A.	24.021
49FE	A	N.A.	641.01	N.A.	19.881
	B	N.A.	641.01	N.A.	19.881
71J	A	N.A.	646.67	N.A.	19.138
	B	N.A.	646.67	N.A.	19.138
1FE	A	N.A.	650.61	N.A.	17.292
	B	N.A.	650.61	N.A.	17.292
47EG	A	N.A.	637.89	N.A.	21.980
	B	N.A.	637.89	N.A.	21.980
57FE	A	N.A.	643.72	N.A.	21.480
	B	N.A.	643.72	N.A.	21.480
48GF	A	N.A.	647.75	N.A.	19.912
	B	N.A.	647.75	N.A.	19.912
51EG	A	N.A.	647.75	N.A.	19.912
	B	N.A.	647.75	N.A.	19.912
55FE	A	N.A.	634.30	N.A.	21.701
	B	N.A.	634.30	N.A.	21.701
45GF	A	N.A.	641.01	N.A.	19.881
	B	N.A.	641.01	N.A.	19.881
51FE	A	N.A.	647.77	N.A.	19.881
	B	N.A.	647.77	N.A.	19.881
59J	A	N.A.	638.83	N.A.	21.676
	B	N.A.	638.83	N.A.	21.676
36GF	A	N.A.	637.46	N.A.	24.021
	B	N.A.	637.46	N.A.	24.021
40FE	A	N.A.	647.77	N.A.	19.881
	B	N.A.	647.77	N.A.	19.881
69J	A	N.A.	643.76	N.A.	19.138
	B	N.A.	643.76	N.A.	19.138

*First Inspection

APPENDIX B

TABLE 1 - SUMMARY OF DATA

Strand Identification	Location	Measured Diam. in.	1% Offset Load lbs.	Ultimate Load lbs.	% Elongation in 10" G.L.	f_{pu}* psi
V22A	End 2	0.251	10520	11850	4.03	239,500
V22A	Mid	0.250	10600	11880	4.52	242,000
V22A	End 1	0.251	10510	11900	5.27	240,500
V231C	End 1	0.251	10350	11890	4.77	240,500
V231	Mid #11	0.251	10310	11870	5.50	240,000
V231C	End 2	0.252	10220	11830	4.45	237,000
B4B4	End 2	0.250	10920	12340	5.20	256,500
B4B4	#7	0.251	10780	12270	4.82	2[illegible],000
B4B4	End 1 #2	0.250	10810	12290	5.69	2[illegible],500
H23FE**	End 1	0.250	11450	12220	3.91	248,500
H23FE	End 2	0.251	11150	12250	4.03	247,500
H23FE**	#9	0.250	11380	12390	3.85	252,500
Re-test						
H23FE	End 1-4A	0.250	11070	12160	4.22	247,500
H23FE	Mid #10 17A	0.250	11020	12220	4.28	248,500

* Computed using ultimate load-lbs and actual measured diameter. f_{pu} results rounded to nearest 500 psi.

** Fracture occurred at test machine jaws. Elongation data not valid. To be retested upon receipt of additional samples.

POST-TENSIONING SHOP FABRICATION RECORD

CUSTOMER: Walsh Const CONTRACT: 24676 PART NO. 107 DATE: 7.24.75

Tendon Mark	Wire Heat Number	Coil Number	Ult. Load of Wire PSI Front	Ult. Load of Wire PSI Middle	No. of Bends	Wire Dia. Front	Wire Dia. Middle	Anchor Head Heat Code	Inspect 10% Button Heads
6BA ✓	47359 ✓	22 ✓	4200 ¼	4200 ¼	6	252	251	JT53 ✓	2697/10475
6BA ✓	27357	66 ✓	4100 ¼	4100 ¼	6	250	250	JT53	
6BA ✓	27358 ✓	57 ✓	4200 ¼	4200 ¼	7	251	251	JT53 ✓	
BA ✓	27357 ✓	70 ✓	4200 ¼	4200 ¼	8	251	251	JT-53 ✓	
6BA ✓	27357 ✓	79 ✓	4200 ¼	4100 ¼	7	251	251	JT-53 ✓	
5BA ✓	27357 ✓	79 ✓	4200 ¼	4100 ¼	7	251	251	JT-64 ✓	
5BA ✓	27358 ✓	59 ✓	4300 ¼	4300 ¼	8	251	251	JT-64 ✓	
5BA ✓	27357 ✓	23 ✓	4300 5½	4200 ¼	7	251	251	JT-64 ✓	
5BA ✓	27358 ✓	136 ✓	4200 ¼	4100 ¼	8	251	251	JT-64 ✓	
4BA ✓	27358 ✓	29 ✓	4200 ¼	4100 ¼	7	251	251	JT 62 ✓	
4BA ✓	27358 ✓	29 ✓	4200 ¼	4200 ⅞	7	251	251	JT 62 ✓	
4BA ✓	27357 ✓	16 ✓	4300 ¼	4200 ⅜	6	251	255	JT 62 ✓	
4BA	[illegible]7358 ✓	160 ✓	4150 ¼	4300 [illegible]	7	252	[illegible]	JT 62 ✓	[illegible]

ACCEPTED [illegible]

Minimum Breaking Load in PSI 4000

Minimum Number of Bends 6

Allowable min. and max. Tolerance for Diameter .248 /.252

Quality Assurance Dept. Reviewed by: [signature]

revised 1-25-71

INLAND-RYERSON CONSTRUCTION PRODUCTS COMPANY

RMCO **Armco Steel Corporation**
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE July 14, 1975

CUSTOMER Inland Ryerson Construction Products Company
P. O. Box 1056
Melrose Park, Illinois 60160

…INAL WIRE DIA. [illegible]

MIN. SPECIFICATIONS

…D'S. BREAKING STRENGTH 11,784 LBS. 240,000 P.S.I.

…NIMUM ELONGATION IN 10" 4.00 PERCENT

Customer Order No. 21T676-1

…IL …	DIAMETER		BREAKING STRENGTH LBS.		ULT. TENSILE STR. PSI		% ELONG 10"	BENDS	STRAIGHT-NESS	BUTTON HEAD	YIELD STRENGT…
	FRONT	BACK	FRONT	BACK	FRONT	BACK					
2	.250	.250	12,360	11,840	251,800	241,200					
[illegible]X	.250	.250	12,140	12,200	[illegible]	248,500					
3 X	.250	.250	12,100	12,200	246,500	248,500					
9 X	.250	.250	12,120	12,260	[illegible]	249,700					
6 X	.250	.250	12,160	12,120	247,700	246,900					
0 X	.250	.250	11,840	12,240	241,600	249,300	5.00	ok	ok	ok	10,48…
7 X	.250	.250	12,080	12,240	246,100	249,300					
1	.250	.250	12,080	12,360	246,100	251,800					

8 Coils, 6,680 lbs

A S T M Specification A 421-65

ACCEPTED/WALSH-QA

HEAT NO. 27357

ANALYSIS .83 C .81 MN .018 P .027 S .21 SI

THE PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

…ubscribed and sworn to before me, A Notary Public
…n and for Jackson County, the State of Missouri.
…his the 15th day of [illegible] 1975

BY [signature]

ARMCO **Armco Steel Corporation**
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE July 14, 1975

CUSTOMER: Inland Ryerson Construction Products Company
P. O. Box 1056
Melrose Park, Illinois 60160

NOMINAL WIRE DIA. .2[illegible]

MIN. SPECIFICATIONS

REQ'D. BREAKING STRENGTH 11,784 LBS. 240,000 P.S.I.

MINIMUM ELONGATION IN 10" 4.00 PERCENT

Customer Order No. 21T676-1

COIL NO.	DIAMETER FRONT	DIAMETER BACK	BREAKING STRENGTH LBS. FRONT	BREAKING STRENGTH LBS. BACK	ULT. TENSILE STR. PSI FRONT	ULT. TENSILE STR. PSI BACK	% ELONG 10"	BENDS	STRAIGHTNESS	BUTTON HEAD	YIELD STRENGTH
29 X	.251	.251	11,900	12,560	[redacted]						
3	.251	.251	12,420	12,100	251,000	244,500					
7 X	.251	.251	12,200	12,200	246,500	246,500					
9 X	.251	.251	12,160	12,260	245,700	247,700					
3 X	.251	.251	11,940	12,380	241,300	250,100					
2 X	.251	.251	11,940	12,220	241,300	246,900					
36X	.251	.251	12,060	12,040	243,700	243,300					
160X	.251	.251	11,920	12,320	[redacted]		5.30	ok	ok		10,[illegible]

8 Coils, 7,070 lbs

A S T M Specification A 421-65

HEAT NO. 27358

ANALYSIS: .81 C .85 MN .013 P .024 S .21 SI

THE PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

Subscribed and sworn to before me, A Notary Public in and for Jackson County, the State of Missouri. [illegible] 1975

BY J P [signature]

POST-TENSIONING SHOP FABRICATION RECORD

CUSTOMER: WALSH CONST CONTRACT: 214676 PART NO. 310 DATE: 10-8-76

Tendon Mark	Wire Heat Number	Coil Number	Ult. Load of Wire PSI Front	Ult. Load of Wire PSI Middle	No. of Bends	Wire Dia. Front	Wire Dia. Middle	Anchor Head Heat Code	Inspect 10% Button Heads
18FE	15361	48	4300 lb	4300 lb	6	251	251	JX-87	1044
18FE	15361	47	4200 lb	4200 lb	6	251	251	JX87	F.R.N.
18FE	29057	50	4200 lb	4200 lb	7	250	250	JX87	
18FE	29057	75	4100 lb	4200 lb	6	250	250	JX87	
18FE	40158	35	4300 lb	4300 lb	6	251	251	JX87	
23FE	40158	[illegible]	4300 lb	4300 lb	6	251	251	JX-76	
23FE	29057	[illegible]	4100 lb	1200 lb	6	251	251	JX-76	
22FE	29057	[illegible]	4300 lb	4200 lb	7	250	250	JX76	
22FE	29057	[illegible]	4200 lb	4200 lb	7	251	250	JX 76	
24FE	29057	45	4200 lb	4200 lb	7	251	250	JX [illegible]113	
24FE	29057	20	4200 lb	4300 lb	6	251	251	JX 113	
24FE	40158	63	4200 lb	4200 lb	6	251	251	JX113	
24FE	40158	25	4100 lb	4200 lb	7	251	251	JX113	
24FE	29057	57	4200 lb	4300 lb	6	251	251	JX113	

Minimum Breaking Load in PSI 4000

Minimum Number of Bends 6

Allowable min. and max. Tolerance for Diameter .248 / .252

Quality Assurance Dept. Reviewed by: [signature]

revised 1-25-71

ARMCO Armco Steel Corporation
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE September 29, 1976

CUSTOMER Inland Ryerson Construction Products Comp
P. O. Box 1056
Melrose Park, Illinois 60160

[NOMIN]AL WIRE DIA. .250"

MIN. SPECIFICATIONS

[MIN]'G. BREAKING STRENGTH 11,784 LBS 240,000 P.S.I.

[MI]NIMUM ELONGATION IN 10" 4.00 PERCENT

Customer Order No. 21T676-1

[CO]IL	DIAMETER FRONT	DIAMETER BACK	BREAKING STRENGTH LBS. FRONT	BREAKING STRENGTH LBS. BACK	ULT. TENSILE STR. PSI FRONT	ULT. TENSILE STR. PSI BACK	% ELONG. 10"	BENDS	STRAIGHTNESS	BUTTON HEAD	YIELD STR[ENGTH]
	.250	.250	12,220	11,980	248,900	244,000	5.40	ok	ok	ok	10,9
	.250	.250	12,120	12,140	246,900	247,300		ok			
	.250	.250	11,900	11,840	242,400	241,200		ok			
	.250	.250	11,920	12,240	242,800	249,300		ok			
	.250	.250	11,880	12,180	242,000	248,100		ok			
	.250	.250	11,980	11,880	244,000	242,000		ok			
	.250	.250	11,800	11,800	240,400	240,400		ok			
35	.250	.250	11,980	12,180	[illegible]	[illegible]	5.00	ok	ok	ok	10,6
	.250	.250	11,900	12,060	242,400	245,700		ok			
	.250	.250	12,180	12,060	248,100	245,700		ok			
	.250	.250	12,020	12,140	244,400	247,300		ok			
	.250	.250	11,980	12,380	244,000	252,200		ok			
	.250	.250	12,160	12,280	247,700	250,100		ok			
	.250	.250	12,060	12,140	245,700	247,300		ok			
	.250	.250	12,300	12,040	250,600	245,300		ok			
	.250	.250	12,200	12,040	248,500	245,300		ok			
	.250	.250	12,280	12,600	250,100	256,700		ok			
	.250	.250	12,000	12,520	244,400	255,000		ok			
	.250	.250	12,120	12,460	246,900	253,800		ok			
	.250	.250	12,160	12,140	247,700	247,300		ok			
	.250	.250	12,460	12,260	253,800	249,700		ok			

21 Coils, 14,900 lbs

A S T M Specification A 421-74, Type B

ACCEPTED WALSH-UA 10/20/76

[HE]AT NO. 40158

[AN]ALYSIS .81 C .88 MN .010 P .022 S 24

APPROVED
QUALITY ASSURANCE SECTION
POST TENSIONING DIVISION
BY: [signature]
DATE: 10-1-76

[TH]E PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT
[AS] CONTAINED IN THE RECORDS OF THE CORPORATION. ..., A Notary Public
in and for Jackson County, the State of Missouri
this the 29th day of September 1976

BY [signature]

ARMCO Armco Steel Corporation
Kansas City, Mo. 64125

CERTIFICATION OF TEST
- TUFWIRE

DATE September 29, 1976

CUSTOMER Inland Ryerson Construction Products Company
P. O. Box 1056
Melrose Park, Illinois 60160

NOMINAL WIRE DIA. .250

MIN. SPECIFICATIONS

REQ'D. BREAKING STRENGTH 11,784 LBS 240,000 P.S.I.

MINIMUM ELONGATION IN 10" 4.00 PERCENT

Customer Order No. 21T676-1

COIL	DIAMETER FRONT	DIAMETER BACK	BREAKING STRENGTH LBS. FRONT	BREAKING STRENGTH LBS. BACK	ULT. TENSILE STR. PSI FRONT	ULT. TENSILE STR. PSI BACK	% ELONG 10"	BENDS	STRAIGHT-NESS	BUTTON HEAD	YIELD STR.
	.250	.250	12,340	12,340	253,400	251,400					
	.250	.250	12,140	12,360	247,300	251,800		ok			
	.250	.250	11,820 -	12,400	240,800	252,600	5.00	ok	ok	ok	10.
	.250	.250	12,580	12,440	256,300	253,400		ok			
45	.250	.250	12,260	12,440	[redacted]	251,400	5.00	ok	ok	ok	11.
46	.250	.250	12,280	12,400	[redacted]	252,60?		ok			
	.250	.250	12,260	12,520	248,700	255,000		ok			
	.250	.250	12,340	12,440	251,400	253,400		ok			
	.250	.250	11,940	12,240	243,200	248,900		ok			
	.250	.250	12,340	12,620	251,400	257,100		ok			
	.251	.251	12,420	12,260	251,000	249,700		ok			
68	.251	.251	12,060	12,140	243,700	245,300		ok			
	.250	.250	12,720	12,580	259,100	256,300		ok			
	.250	.250	12,700	12,840	258,700	257,500		ok			
	.250	.250	12,260	12,660	[redacted]	257,900		ok			
	.250	.250	12,240	12,680	249,300	258,300		ok			
	.250	.250	12,380	12,380	252,200	252,200		ok			
	.250	.250	12,260	12,540	249,700	255,400		ok			
	.250	.250	12,140	12,280	247,300	250,100		ok			
	.250	.250	12,220	12,320	248,900	251,000		ok			

38 Coils, 26,245 lbs

A S T M Specification A 421-74, Type BA

ACCEPTED WALSH-O
[signature] 10/?/76

APPROVED
QUALITY ASSURANCE SECTION
POST ENGINEERING DIVISION
BY: [signature]
DATE 10-1-76

HEAT NO. 29057

ANALYSIS .84 C .84 MN .010 P .020 S .22 SI

THE PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

Subscribed and sworn to before me, A Notary Public in and for Jackson County, the State of Missouri this the ... of ... 6, 1976

BY [signature]
Sup'r. Quality Control Wire

POST-TENSIONING SHOP FABRICATION RECORD

CUSTOMER: LA SALLE #1 & 2 21T 676 CONTRACT: 2 11 676 PART NO. 485 DATE: 11-30-77

Tendon Mark	Wire Heat Number	Coil Number	Ult. Load of Wire PSI Front	Ult. Load of Wire PSI Middle	No. of Bends	Wire Dia. Front	Wire Dia. Middle	Anchor Head Heat Code	Inspect lot Button Heads
V23A	35681	93	4200 1/4	4300 1/4	7	250	250	KU343	11709
V23A	20449	97	4300 1/4	4300 1/4	7	251	251	KU343	
V22A	356[illegible]	[illegible]	4300 1/4	4300 1/4	6	251	251	KU339	
V22A	35679	14	4300 1/4	4300 1/4	7	250	250	KU339	
V21A	35679	14	4300 1/4	4300 1/4	7	250	250	KU345	
V21A	35681	27	4300 3	4200 1/4	7	250	250	K1134[illegible]	10495
V21A	20449	71	4300 1/4	4300 [illegible]	6	251	251	K1134[illegible]	

ACCEPTED / W.A. [illegible] QA 12 [illegible] 77

Minimum Breaking Load in PSI 4000

Minimum Number of Bends 6

Allowable min. and max. Tolerance for Diameter .248 /.252

Quality Assurance Dept. Reviewed by: Rubio

Armco Steel Corporation
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE August 17th, 1977

CUSTOMER Inland Ryerson Construction Products Comp
P. O. Box 1036
Melrose Park, Illinois 60160

NOMINAL WIRE DIA. [redacted]

MIN. SPEC. [redacted]

REQ'D. BREAKING STRENGTH 11,[illegible] LBS. 240,000 P.S.I.

MINIMUM ELONGATION IN 10" 4.00 PERCENT

Customer Order No. 213979-2

COIL NO.	DIAMETER FRONT	DIAMETER BACK	BREAKING STRENGTH LBS. FRONT	BREAKING STRENGTH LBS. BACK	ULT. TENSILE STR. PSI FRONT	ULT. TENSILE STR. PSI BACK	% ELONG. IN 10"	BENDS	STRAIGHTNESS	BUTTON HEAD	
1	.251	.251	12,060	12,060	243,700	243,700		ok			
2	.251	.251	12,300	12,120	248,500	244,900		ok			
3	.251	.251	12,140	12,000	245,300	242,500		ok			
4	.251	.251	12,100	12,300	244,500	248,500		ok			
7	.251	.251	12,120	12,120	244,900	244,900		ok			
11	.251	.251	12,080	11,920	244,100	240,900		ok			
12	.251	.251	12,260	12,100	247,700	[redacted],500		ok			
14	.251	.251	12,120	12,060	[redacted]	[redacted]		ok			
17	.251	.251	11,940	12,380	241,300	250,100		ok			
18	.251	.251	12,180	11,920	246,100	240,900		ok			
19	.251	.251	12,180	12,120	246,100	244,900		ok			
23	.251	.251	12,040	12,000	243,300	242,500		ok			
25	.251	.251	12,120	12,240	244,900	247,300	4.40	ok	ok	ok	11
28	.251	.251	12,080	12,000	244,100	242,500		ok			
3.	.251	.251	12,180	12,200	246,100	246,500		ok			
39	.251	.251	12,060	12,260	243,700	247,700		ok			
45	.251	.251	12,040	12,260	243,300	247,700	4.30	ok	ok	ok	10
53	.251	.251	12,060	12,160	243,700	245,700		ok			
55	.251	.251	12,140	12,260	245,300	247,700		ok			
56	.251	.251	12,060	12,040	243,700	243,300		ok			
59	.251	.251	12,260	12,100	247,700	244,500		ok			
74	.251	.251	12,300	12,060	[redacted]	[redacted]		ok			
75	.251	.251	12,220	12,060	246,900	243,700	4.80	ok	ok	ok	11
82	.251	.251	[redacted]	12,020	246,900	242,900		ok			
85	.251	.251	[redacted]	12,160	242,900	245,900		ok			
89	.251	.251	[redacted]	11,940	246,500	241,300		ok			
90	.251	.251	[redacted]	12,200	242,900	246,500		ok			
99	.251	.251	[redacted]	12,220	244,900	246,900		ok			
103	.251	.251	12,180	11,940	246,100	241,300		ok			
			29 Coils	42,355	lbs. A S T M	Specification A	421-76,	Type BA			

HEAT NO. 35679

ANALYSIS .80 C .85 Mn .010 P .022 S

THE PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

Subscribed and sworn to before me, A Notary Public in and for Jackson County, the State of Missouri

This the 17th day of August 1977

BY [signature]
Senior Product Metallurgist

POST-TENSIONING SHOP FABRICATION RECORD

CUSTOMER: Walsh Const CONTRACT: 21T676 PART NO. 416 DATE: 3-1-77

Tendon Mark	Wire Heat Number	Coil Number	Ult. Load of Wire PSI Front	Ult. Load of Wire PSI Middle	No. of Bends	Wire Dia. Front	Wire Dia. Middle	Anchor Head Heat Code	Inspect 10% Button Heads
V235C	34478	25	4300 1/4	4300 1/4	7	251	251	KU-143	2999
V235C	40724	69	4300 13/4	4300 13/4	7	251	251	KU-143	"
V235C	40724	83	4300 1/4	4300 1/4	8	251	251	KU-143	"
234C	40724	83	4300 1/4	4300 1/4	8	251	251	KU-384	"
V234C	40990	10	4300 1/4	4300 1/4	8	251	251	KU-384	"
V233C	40990	10	4300 1/4	4300 1/4	8	251	251	KU-82	"
V233C	40724	75	4300 1/4	4300 1/4	7	251	251	KU-82	"
V232C	40724	75	4300 1/4	4300 1/4	7	251	251	KU-374	"
V232C	40724	72	4400 1/4	4300 1/4	7	251	251	KU-374	"
V231C	40724	92	4400 1/4	4300 1/4	7	251	257	KU-136	"
V231C	40724	82	4300 1/4	4300 1/4	8	251	251	KU-136	"
V231C	40990	5	4300 1/4	4300 1/4	6	251	251	KU-136	"
								WALSH-QA	
								Eon 3-8-77	

Minimum Breaking Load in PSI 4000

Minimum Number of Bends 6

Allowable min. and max. Tolerance for Diameter .248 /.252

Quality Assurance Dept. Reviewed by: F. Rubio

revised 1-25-71

ARMCO Armco Steel Corporation
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE FEBRUARY 17, 1977

CUSTOMER: INLAND RYERSON CONSTRUCTION PRODUCTS
MELROSE PARK, ILLINOIS

NOMINAL WIRE DIA. [redacted] .250"

MIN. SPECI[redacted]

REQ'D. BREAKING STRENGTH [redacted] 786 LBS. 240,000 P.S.I.

MINIMUM ELONGATION IN 10" 4.00 PERCENT

COIL NO.	DIAMETER		BREAKING STRENGTH LBS.		ULT. TENSILE STR. PSI		% ELONG 10"	BENDS	STRAIGHT-NESS	BUTTON HEAD	T... STR...
	FRONT	BACK	FRONT	BACK	FRONT	BACK					
[illegible]	.251	.251	12,420	12,340	251,000	249,300		ok			
[illegible]	.251	.251	12,240	12,220	247,300	246,900		ok			
[illegible]	.251	.251	11,960	11,900	241,700	240,000	5.00	ok	ok	ok	12,
[illegible]	.251	.251	12,080	12,440	244,100	251,400		ok			
[illegible]	.251	.251	12,260	12,400	247,700	250,600		ok			
[illegible]	.251	.251	12,420	12,380	251,000	250,100		ok			
[illegible]	.251	.251	12,400	12,600	250,600	254,600		ok			
[illegible]	.251	.251	12,500	12,440	252,600	251,400		ok			
[illegible]	.251	.251	12,280	12,120	248,100	244,900		ok			
72[illegible]	.251	.251	12,220	12,400	[redacted]	[redacted]		ok		[redacted]	
[illegible]	.251	.251	12,260	12,260	247,700	247,700		ok			
[illegible]	.251	.251	12,120	12,300	244,900	248,500	5.00	ok	ok	[redacted]	10,
[illegible]	.251	.251	12,020	12,240	242,900	247,300		ok			
[illegible]	.251	.251	12,340	12,300	249,300	248,500		ok			
279	.251	.251	12,260	12,320	248,100	248,900		ok			
[illegible]	.251	.251	12,180	12,340	246,100	249,300	4.70	ok	ok	ok	11,
82[illegible]	.251	.251	12,220	12,220	[redacted]	[redacted]		ok			
[illegible]	.251	.251	12,040	12,320	243,300	248,900		ok			
[illegible]	.251	.251	12,220	12,280	246,900	248,100		ok			
[illegible]	.251	.251	11,960	12,200	241,700	246,500	5.60	ok	ok	ok	10,

(20 Coils, 29,915 lbs. ASTM Specification A-421-74 Type BA

ACCEPTED / WALSH-QA
Eon J 3-8-77

HEAT NO. 40724

ANALYSIS: .85 C .75 MN .010 P .028 S .17 SI

INRYCO APPROVED
QUALITY ASSURANCE SECTION
POST TENSIONING DIVISION
BY [signature] DATE 3-11
HEAT CODE ——
DRAWING ——
CONFORMS TO A421

[signature]

... PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

... Notary Public
In and for Jackson County, the State of Missouri
This the 17 day of Feb. 1977
My Commission Expires ... 1980

BY D.P. Thompson
SUPV., QUALITY CONTROL
HIGH CARBON WIRE & ROPE

Armco Steel Corporation
Kansas City, Mo. 64125

CERTIFICATION OF TEST
TUFWIRE

DATE FEBRUARY 22, 1977

CUSTOMER: INLAND RYERSON CONSTRUCTION PRODUCTS
MELROSE PARK, ILLINOIS

N AL WIRE DIA. [redacted]

NOM. [redacted]

REQ'D. BREAKING STRENGTH 11,786 LBS. 240,000 P.S.I.

MINIMUM ELONGATION IN 10" 4.00 PERCENT

CUSTOMER ORDER NO. 21T546

COIL NO.	DIAMETER		BREAKING STRENGTH LBS.		ULT. TENSILE STR. PSI		% ELONG 10"	BENDS	STRAIGHT-NESS	BUTTON HEAD
	FRONT	BACK	FRONT	BACK	FRONT	BACK				
01	.251	.251	12,320	12,360	248,900	249,700		ok		
02	.251	.251	12,160	12,020	245,700	242,900		ok		
05	.251	.251	11,920	11,940	[redacted]	[redacted]	5.30	ok	ok	ok
06	.251	.251	11,900	12,320	240,400	248,900		ok		
07	.251	.251	12,080	12,060	244,100	243,700		ok		
08	.251	.251	12,000	11,960	242,500	241,700		ok		
09	.251	.251	11,900	12,120	240,400	244,900		ok		
10	.251	.251	12,040	12,440	243,300	251,400	5.00	ok	ok	ok
11	.251	.251	12,260	12,100	247,700	244,500		ok		
12	.251	.251	12,140	12,360	245,300	249,700		ok		
13	.251	.251	12,060	12,040	243,700	243,300		ok		
14	.251	.251	12,160	12,040	245,700	243,300		ok		
15	.251	.251	12,040	12,260	243,300	247,700	4.50	ok	ok	ok
16	.251	.251	11,900	12,200	240,400	246,500		ok		
1[illegible]	.251	.251	12,220	12,220	246,900	246,900		ok		
18	.251	.251	12,020	12,120	242,900	244,900		ok		
19	.251	.251	12,080	12,200	244,100	246,500		ok		
20	.251	.251	12,000	12,100	242,500	244,500	5.00	ok	ok	ok
21	.251	.251	11,960	12,240	241,700	247,300		ok		
2[illegible]	.251	.251	12,120	12,0[illegible]0	244,900	242,900		ok		

(20 Reels, 29,620 lbs. ASTM Specification A 421-74 Type BA)

ACCEPTED / WALSH-QA
3-8-77

HEAT NO. 40990

ANALYSIS .81 C .83 MN .010 P .021 S .22 SI

Inryco
QUALITY ASSURANCE S
POST TENSIONING D
BY ___ DATE ___
HEAT CODE ___
DRAWING ___
CONFORMS TO A421-65

THE PHYSICAL OR MECHANICAL TEST REPORTED ABOVE ARE CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

Subscribed and sworn to before me, A Notary Public in and for Jackson County, the State of Missouri This the 22 day of Feb. 1977

BY ___
SUPV., QUALITY CONTROL