

# 8

## TOWER SADDLE TIE RODS

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*(2010) – 25 Rods*

*Fabrication Process*

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### Tower Saddle Tie Rod

#### 2010 TIMELINE

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#### ADDITIONAL DOCUMENTS

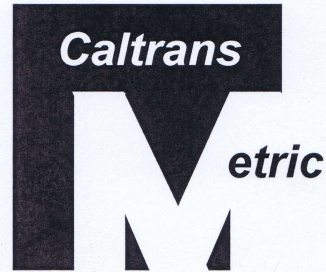
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ASTM A123  
ASTM A143  
ASTM A153  
ASTM A354  
ASTM A490



Location and Item		Component Description	Rod (no head) or Bolt (with head)	Threads Cut or Rolled	Supplier	Diameter (in)	Overall Length (ft)	Overall Length (mm)	Quantity Installed (not including spares)		De-Humidified Zone?	Tighten Method	Final Tension (fraction of Fu or UTS)	Date Tension or Loading Complete	Date Re-Inspected (by 4/8/13)	Date Re-Inspected (by 4/23/13)	Date Re-Inspected (by 5/5/13)	Notes
E2 Bearings and Shear Keys	1	E2 Shear Key - Connect to Concrete - Above Column, Under OBG [S1, S2]	rod	Cut	Dyson	3	17.2 10.0	5235 3035	60 36	96	No	Tension	0.7	3/5/2013	daily check	daily check	daily check	Tensioned to 0.75 Fy, with lockoff at ~ 0.7 Fu 32 of 96 rods broke after tensioning, then tension level lowered
	2	E2 Shear Key - Connect to Concrete - Above Bent Cap, Under Crossbeam [S3, S4]	rod	Cut	Dyson	3	21.9	6676	96		No	Tension	0.7	4/1/2013	daily check	daily check	daily check	Tensioned to 0.75 Fy, with lockoff at ~ 0.7 Fu
		E2 Bearing - Connect to Concrete - Under OBG [B1, B2, B3, B4]	rod	Cut	Dyson	3	22.6 22.2	6902 6777	64 32	Tension		0.7	4/9/2013	daily check	daily check	daily check	Tensioned to 0.75 Fy, with lockoff at ~ 0.7 Fu	
	3	E2 Shear Key - Connect to OBG [S1, S2]	rod	Cut	Dyson	3	4.4 1.8	1337 537	96 64	320	No	Tension	0.7	9/12/2012	4/6/2013 4/8/2013	4/17/13 to 4/23/13	5/3/2013	Tensioned to 0.75 Fy, with lockoff at ~ 0.7 Fu
		E2 Shear Key - Connect to Crossbeam [S3, S4]	rod	Cut	Dyson	3	4.3 1.7	1312 512	96 64									
		4	E2 Bearing - Connect to OBG [B1, B2, B3, B4]	rod	Cut	Dyson	2	3.6	1105									
	5	E2 Bearing Assembly Bolts (Spherical Bushing Halves)	rod	Cut	Dyson for Lubrite for Hochang	1	2.4	733	96	No	Tension	0.61	July 2009	not accessible	not accessible	not accessible	Connect 2 halves of the spherical bushing assembly housing together at Lubrite; rods are internal to bearings and <b>all rods are not accessible</b> after bearing assembly at Hochang (December 2009 & January 2010); rods tensioned to 0.7 Fy.	
	6	E2 Bearing Assembly Bolts (Retaining Rings)	Socket Head Cap Screw	Cut	Dyson for Hochang	1	0.2	55	336	No	snug + 1/4 turn	~0.4	January 2010	4/6/2013 (for 32 accessible bolts)	4/23/2013 (for 32 accessible bolts)	5/3/2013 (for 32 accessible bolts)	Bolts thread into drill and tap holes to attach retaining rings that secure the Lubrite spherical bushing assembly in the bottom housing; bolts are mechanically galvanized, not hot dip galvanized; bolts are internal to bearings and not accessible after bearing assembly at Hochang, except for a small number of bolts in limited areas -> <b>32 of 336 bolts are accessible.</b>	
Cable Anchorage	7	PWS Anchor Rods - PWS Socket to Anchorage	rod	55 Cut (20%) 219 Rolled (80%)	Dyson	3-1/2	27.9 to 31.8	8500 to 9700	274	Yes	Load Transfer	0.26	9/26/2012	4/6/2013	4/20&22/2013	5/4/2013	With DL after load transfer (current condition)	
												0.29	N/A	N/A	N/A	N/A	With DL + Added DL	
												0.32	N/A	N/A	N/A	N/A	Service Load (Group 1)	
												0.35	N/A	N/A	N/A	N/A	SEE (Seismic)	
Top of Tower	8	Tower Saddle Tie Rods	rod	Rolled	Dyson	4	6.0 to 17.5	1840 to 5325	25	Yes	Tension	0.41	7/14/2012	N/A	N/A	N/A	Load During Construction - Tensioned to 0.5 Fy	
												0.68	N/A	4/6/2013	4/19/2013	5/3/2013	Additional tension in tie rods from cable with service load	
	9	Turned Rods at Tower Saddle Segment Splices	rod	Cut	Dyson	3 @ Threads [-3-1/16 @ Shank]	1.5 1.4	463 415	100 8	108	Yes	Tension	0.45	4/6/2011	4/6/2013	4/19/2013	5/3/2013	Located at the 2 field splices connecting the 3 tower saddle segments; 100 rods tensioned prior to saddle erection; 8 rods only snug tight after tie rod tensioning due to conflict with tie rods.
	snug	~0.1	7/14/2012															
	10	Tower Saddle to Grillage Anchor Bolts	Hex Bolt	Cut	Dyson	3	1.2	360	90	Head Yes, Nut No	snug	~0.1	3/25/2013	4/6/2013	4/19/2013	5/3/2013	Snug tightened before and after load transfer: <b>Initial Tension complete on 5/20/2011; final tension complete on 3/25/2013.</b>	
11	Tower Outrigger Boom (for Maintenance) at Top of Tower	Hex Bolt	Cut	Dyson	3	2.1	630	4	No	snug	~0.1	July 2012	4/6/2013	4/19/2013	5/4/2013	Act as pins for swinging out and then securing the maintenance outrigger boom at the top of 2 of 4 tower head chimneys. At each boom, one bolt is loaded and other bolt is unloaded in the current boom position. The currently unloaded bolt will be installed snug tight when the boom is swung out for use (future position).		
Bottom of Tower	12	Tower Anchor Rods - Tower at Footing (3" Dia)	rod	Cut	Vulcan Threaded Products for KOS for KFM (04-0120E4)	3	25.6	7789	388	Yes	Tension	0.48	4/17/2013	N/A	4/20/2013 4/22/2013	5/5/2013	Tensioned to 1800 kN = 404.7 kips; Tension before and after load transfer: <b>Initial Tension Late 2010 through Early 2011; Final Tension 2013</b>	
	13	Tower Anchor Rods - Tower at Footing (4" Dia)	rod	Cut		4	25.7	7839	36	Yes	Tension	0.37	4/17/2013	N/A	4/20/2013 4/22/2013	5/5/2013	Tensioned to 2530 kN = 568.8 kips; Tension before and after load transfer: <b>Initial Tension Late 2010 through Early 2011; Final Tension 2013</b>	
East Saddles	14	East Saddle Anchor Rods	rod	Cut	Dyson for JSW	2	2.6	800	32	Yes	snug	~0.1	May 2010	4/7/2013	4/21/2013	5/3/2013	specified gap under nut/washer at one end of rod and 2 nuts snug against each other at other end of rod -> snug tight for portion of rod	
	15	East Saddle Tie Rods	Hex Bolt	Cut	Dyson	3	4.7	1420	18	Yes	snug	~0.1 0.2	4/13/2012 N/A	N/A 4/7/2013	N/A 4/21/2013	N/A 5/3/2013	Snug tightened before load transfer Additional tension in tie rods from cable with service load	
East Cable	16	B14 Cable Bands - Cable Brackets - at East End of Bridge - Strongback Anchor Rods	rod	Rolled	Dyson	3	10.3 to 11.1	3129 to 3372	24	No	Tension	0.16	2/8/2013	4/7/2013	4/21/2013	5/4/2013	pre-compress neoprene between strongback and cable band	
W2 Bent Cap	17	W2 Bikepath Anchor Rods	rod	Cut	Dyson	~1-3/16 [Metric M30]	1.5	460	43	No	Not Determined Yet		N/A	N/A	N/A	N/A	Details for bikepath connections are being redesigned and are not final. The 18 anchor rods at the bottom connections will be abandoned. The 25 anchor rods at the top connections will be used and supplemented with additional anchor rods. These rods will be tensioned on the separate YBITS-2 Contract.	

Total = 2306 New information after 5/6/2013 Update is highlighted Red



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

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**NOTICE TO CONTRACTORS  
AND  
SPECIAL PROVISIONS  
FOR CONSTRUCTION ON STATE HIGHWAY IN  
SAN FRANCISCO COUNTY IN SAN FRANCISCO  
FROM 0.6 KM TO 1.3 KM EAST OF THE YERBA BUENA TUNNEL EAST PORTAL**

**DISTRICT 04, ROUTE 80**

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**For Use in Connection with Standard Specifications Dated JULY 1999, Standard Plans Dated JULY 1999, and Labor  
Surcharge and Equipment Rental Rates.**

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**CONTRACT NO. 04-0120F4**

**04-SF-80-13.2/13.9**

**Bids Open: February 1, 2006  
Dated: August 1, 2005**

**OSD**



persons or entities hired by subcontractors who will provide other services or materials for the project, and shall have the following:

- A. A tensile testing machine capable of breaking the largest size of reinforcing bar to be tested.
- B. Operators who have received formal training for performing the testing requirements of ASTM Designation: A 970/A 970M.
- C. A record of annual calibration of testing equipment performed by an independent third party that has 1) standards that are traceable to the National Institute of Standards and Technology, and 2) a formal reporting procedure, including published test forms.

The Engineer shall be notified in writing when any lots of headed bar reinforcement are ready for testing. The notification shall include the number of lots to be tested and the location where the tests are to be conducted. After notification has been received, test samples will be randomly selected by the Engineer from each production lot of headed bar reinforcement which is ready for shipment to the jobsite. If epoxy coating is required, test samples will be taken after the headed bar reinforcement has been prepared for epoxy coating. The Engineer will be at the testing site within a maximum of one week after receiving written notification that the samples are at the testing site and ready for testing. In the event the Engineer fails to be present at the testing site within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by failure of the Engineer to be present at the testing site, the Contractor will be compensated for any resulting loss in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

A minimum of 3 samples from each production lot shall be tested. One tensile test shall be conducted on each sample.

Tensile tests shall conform to the requirements specified in ASTM Designation: A 970/A 970M, Section 7, except that at rupture, there shall be visible signs of necking in the reinforcing bar 1) at a minimum distance of one bar diameter away from the head to bar connection for friction welded headed bar reinforcement, or 2) outside the affected zone for integrally forged headed bar reinforcement.

The affected zone for integrally forged headed bar reinforcement is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered during the manufacturing process.

If one of the test specimens fails to meet the specified requirements, one retest shall be performed on one additional sample, selected by the Engineer, from the same production lot. If the additional test specimen, or if more than one of the original test specimens fail to meet these requirements, all headed bar reinforcement in the lot represented by the tests will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

A Production Test Report for all testing performed on each lot shall be prepared by the independent testing laboratory and submitted to the Engineer as specified herein. The report shall be signed by an engineer who represents the laboratory and is registered as a Civil Engineer in the State of California. The report shall include the following information for each set: contract number, bridge number, lot number, bar size, type of headed bar reinforcement, physical conditions of test sample, any notable defects, limits of affected zone, location of visible necking area, and the ultimate strength of each headed bar.

Each unit of headed bar reinforcement in a production lot to be shipped to the site shall be tagged in a manner such that production lots can be accurately identified at the jobsite. All unidentified headed bar reinforcement received at the jobsite will be rejected.

## **MEASUREMENT AND PAYMENT**

Full compensation for headed bar reinforcement shall be considered as included in the contract price paid per kilogram for bar reinforcing steel (bridge) and no separate payment will be made therefor.

Full compensation for epoxy-coated headed bar reinforcement shall be considered as included in the contract price paid per kilogram for bar reinforcing steel (epoxy-coated) (bridge) and no separate payment will be made therefor.

## **10-1.59 STEEL STRUCTURES**

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Fabricators and suppliers shall be certified under the AISC Quality Certification Program, Category Cbr, Major Steel Bridges, with endorsement F, Fracture Critical members, except that certification will not be required for fabrication of the tower strut façade and tower skirt. Alternatively, ISO 9001:2000 certification standard may be substituted for the AISC Quality Certification Program.

Details of box girder and crossbeam connections shall conform to the AASHTO Standard Specifications for Highway Bridges, unless otherwise shown on the plans.

Attention is directed to "Accelerated Working Drawings Submittal," of these special provisions.



- A. Minimum tension shall be verified using the "Pre-Installation Verification Turn-of-the-Nut Method," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated, except that the required rotation shall be as given in Table 8.2. of this section and the required tension shall be as shown in the following table:

**Pre-Installation Verification  
Required Tension, N\***

Bolt Size, mm	A325M Bolts	A490M Bolts
M16	96 000	120 000
M20	149 000	188 000
M22	185 000	232 000
M24	215 000	270 000
M27	280 000	351 000
M30	342 000	428 000
M36	499 000	625 000
*The above values are 5% higher than the required pretension values used for design, actual installation and inspection, rounded to the nearest kN.		

- B. Rotational-capacity tests in accordance with the requirements in Section 11.5.6.4.2 "Rotational-Capacity Tests," of the AASHTO LRFD Bridge Construction Specifications, except that Table 11.5.6.4.1-2 "Nut Rotation from the Snug Condition," is replaced by Table 8.2. of this section.

Test results shall confirm both the minimum bolt tension and the rotational capacity of the bolts. If either test fails, the Contractor shall modify the nut rotation in Table 8.2. of this section until the requirements of both tests are satisfied. No adjustment in compensation will be allowed for modifications to the nut rotations as necessary to satisfy test requirements. Revisions to Table 8.2. shall be approved by the Engineer prior to bolting operations.

The Engineer will randomly sample and perform quality assurance testing of high strength fasteners. Samples will be obtained at locations chosen by the Engineer. The Contractor shall provide the number of bolts specified below to the Engineer for quality assurance testing:

**Bolt Sampling Size**

Lot Size (No. of Bolts)	Sample Size (No. of Bolts)
2 to 15	3
16 to 25	4
26 to 50	5
51 to 90	7
91 to 150	8
151 to 280	9
281 to 10,000	12
10,001 to 500,000	16
500,001 and over	20

Steel fasteners, designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall conform to the requirements of ASTM Designation: A 354. Steel fastener components for steel fasteners designated as A 354 shall include a bolt, nut and hardened washer. Nuts for steel fasteners designated as A 354 shall conform to Section 55-2.01, "Description," of the Standard Specifications.

Steel fasteners designated on the plans as A 354, Grade BD shall be dry blast cleaned in accordance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings."

Steel fasteners designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall be galvanized in accordance with the requirements in Section 75-1.05, "Galvanizing," of the Standard Specifications and shall conform to the requirements in ASTM Designation: A123 for bolts and ASTM Designation: A153 for nuts and hardware. Steel fastener assemblies designated as A354, Grade BD, shall be galvanized within 4 hours of being dry blast cleaned.



The Contractor shall submit certified test reports showing that the A 354, Grade BD fasteners conform to the provisions in ASTM Designation: A 143.

Steel fasteners, designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall conform to the requirements of ASTM Designation: A 354. Steel fastener components for steel fasteners designated as A 354 shall include a bolt, nut and hardened washer. Nuts for steel fasteners designated as A 354 shall conform to Section 55-2.01, "Description," of the Standard Specifications. Nuts shall be zinc coated and be furnished with a dry lubricant conforming to Supplementary Requirement S1 and S2 in ASTM Designation: A 563.

Steel fasteners designated on the plans as A 354, Grade BD shall be tensioned not less than the value shown on the plans. Prior to installation, the Contractor shall submit to the Engineer for approval the methods and equipment to be used to tension steel fasteners designated as A354, Grade BD in accordance with Section 55-1.02, "Drawings," of the Standard Specifications. Working drawings shall include methods and equipment to be used to evaluate: 1) the presence of a lubricant, 2) the efficiency of the lubricant, and 3) the compatibility of the high strength steel bolt, nut and hardened washer.

Except where sub-punching is permitted, bolt holes shall be drilled or reamed, unless otherwise shown on the plans.

### **Punching**

The first paragraph of Section 55-3.14A(1) "Punching," of the Standard Specifications shall not apply.

Punching or sub-punching of Grade 250 structural steel where the material is thicker than 16 mm will not be permitted. Punching or sub-punching of high-strength structural steel where the material is thicker than 12 mm will not be permitted.

### **Prestressing High-Strength Bolts**

High-strength A354 bolts shall be tensioned by means of hydraulic jacks so that the force in the bolts shall not be less than the value shown on the plans.

The maximum temporary tensile stress (jacking stress) in high-strength bolts shall not exceed 75 percent of the specified minimum ultimate tensile strength of the material. Prestressing forces in high-strength bolts shall consider all losses, including creep of steel, losses due to sequence of stressing, and other losses specific to the method or system of prestressing used by the Contractor.

Hydraulic jacks used for prestressing high-strength bolts shall be calibrated in accordance with the requirements in Section 50-1.08, "Prestressing," of the Standard Specifications.

Final prestressing high strength A354 bolts at the tower anchorage shall be performed after the full dead load is transferred to the cable system.

### **ASSEMBLY**

The method of erection of the suspended structure and tower shall be determined by the Contractor to meet the seismic design load criteria and ensure control of box girder and tower deflections due to wind induced oscillations.

The Contractor shall carry out the necessary structural analyses for the erection procedure to demonstrate the adequacy of the procedure. Details of these analyses and of any supplementary damping or other measures shall be submitted to the Engineer for review and approval.

Wind pressure effects during erection shall be calculated using a gust wind appropriate to a return period of not less than 25 years and shall allow for variation of speed with height per ANSI ASCE 7-95. The 25-year wind corresponds to a 77 mph one-hour average wind speed (and a corresponding 3-second gust wind speed of 100 mph) at deck elevation of 50 meters, as well as a critical flutter wind speed threshold of 112 mph based on a 1000-year return period. The Contractor shall provide temporary connections between adjacent lift sections in order to ensure sufficient torsional stiffness of the suspended structure. The Contractor shall also provide the proper support of the suspended structure during all stages of erection. The Contractor shall similarly ensure control of tower deflections due to wind-induced oscillations at all stages of erection and shall provide holdback stays or other damping devices as necessary. All such temporary measures shall be approved by the Engineer.

Wind design loads may be reduced during lifting operations.

Seismic loading during erection shall conform to the seismic loading requirements specified in "TEMPORARY TOWERS," subsection "TEMPORARY TOWER DESIGN," subsection "Seismic Design Loads," of these special provisions.

The erection procedure shall be such that the maximum stresses in any part of the permanent structure do not cause any permanent deformation or damage. Appropriate values of loads and safety factors for erection loading conditions shall be submitted by the Contractor to the Engineer for review and approval.

The details of any fastenings which the Contractor may require in any part of the permanent works for erection, and the procedure for their removal, shall be submitted to the Engineer for approval.

### **Tower**

Tower lifts shall be in lengths as indicated on the plans. Exterior plates of the tower shafts shall be fabricated with direction of rolling aligned along the vertical direction of the tower. Within each lift, the number of transverse splices of the



DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	SF	80	13.2/13.9	779R	1204

REGISTERED ENGINEER - CIVIL

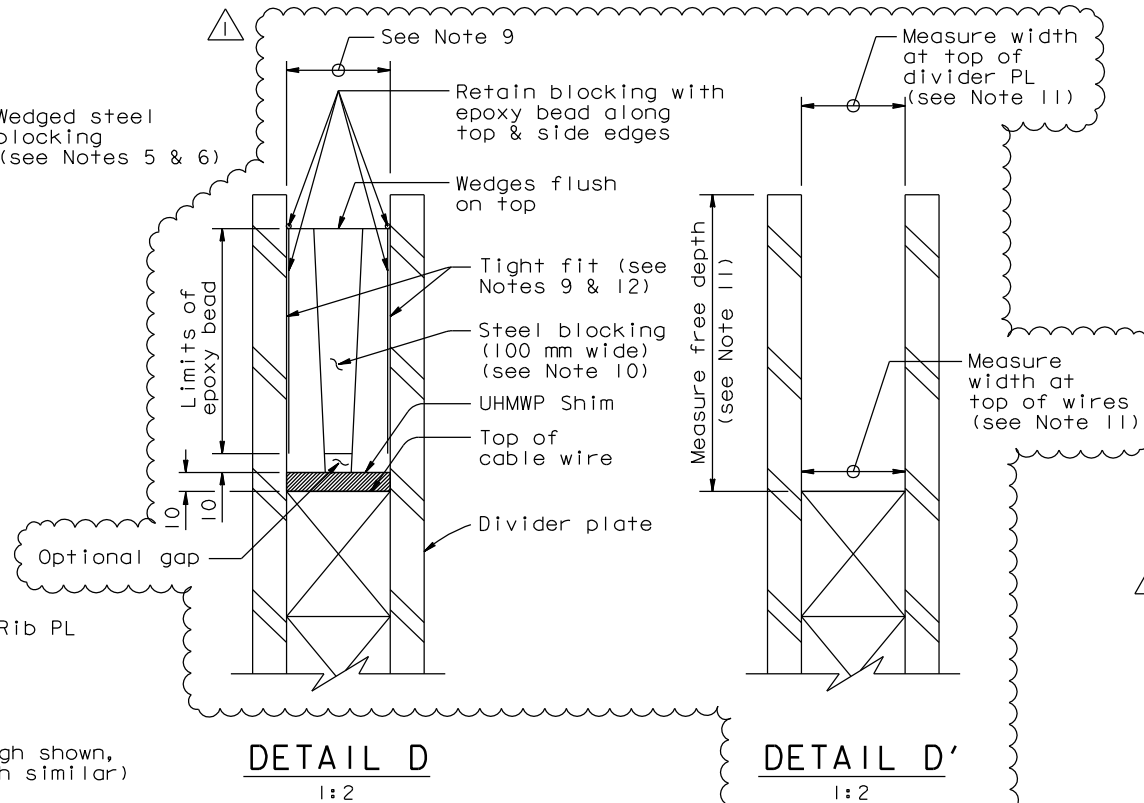
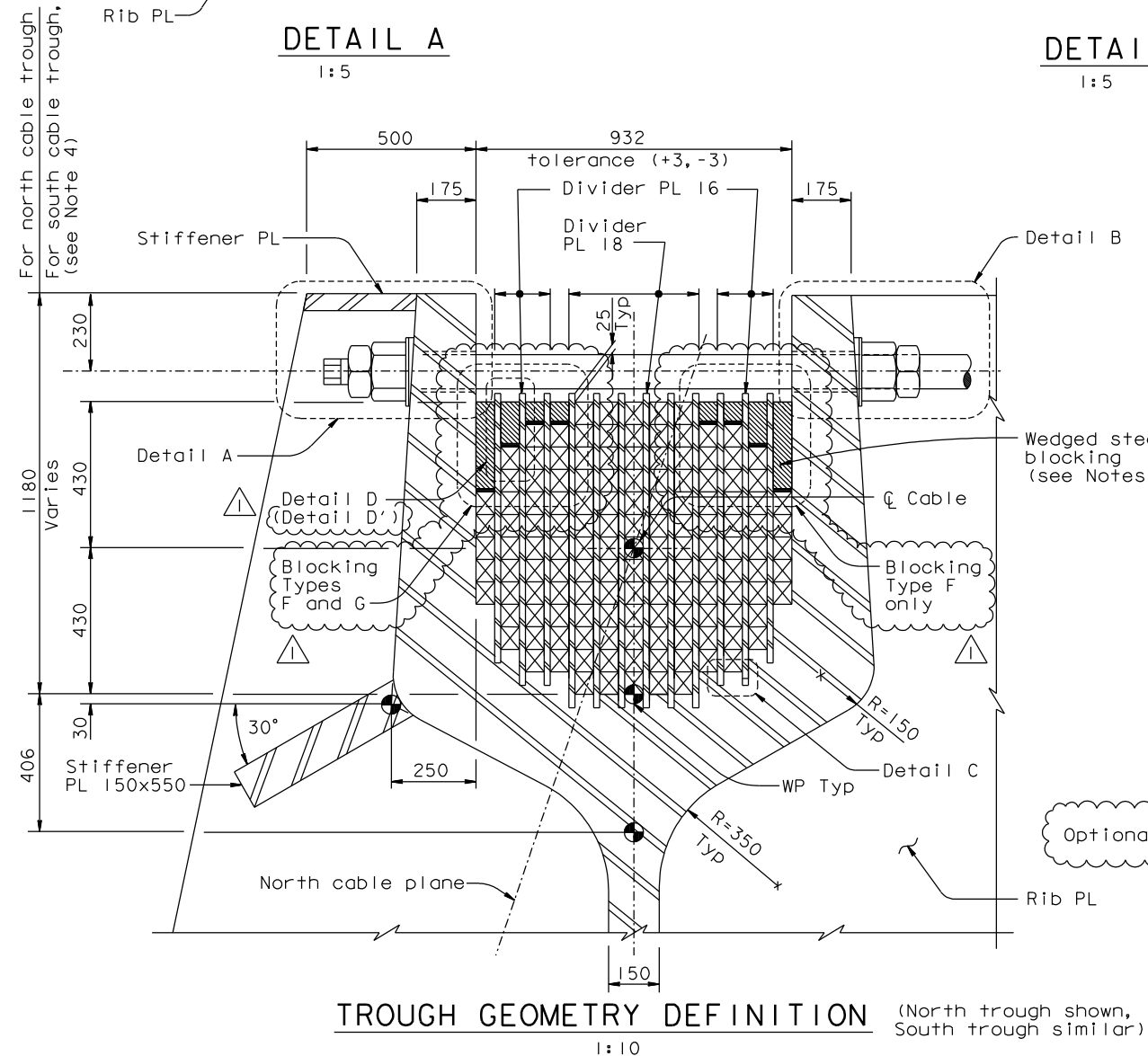
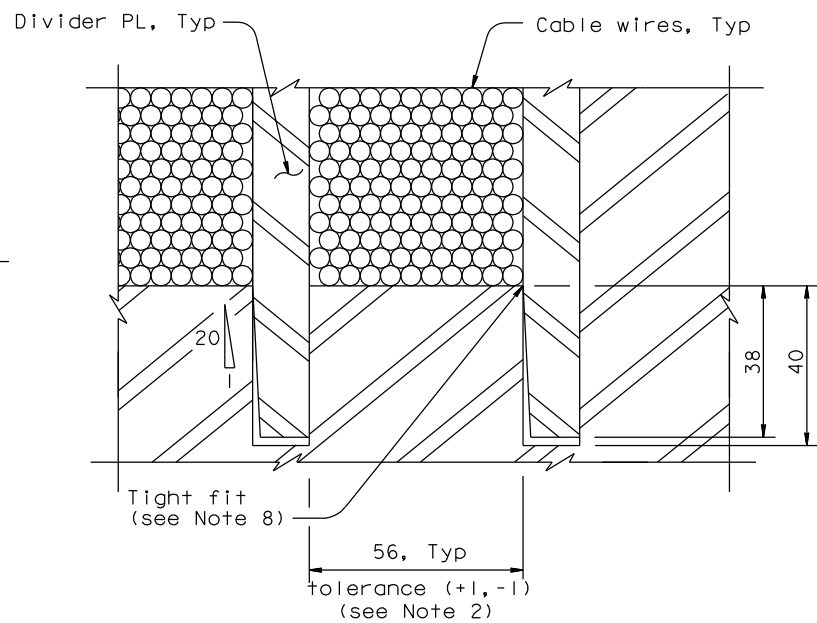
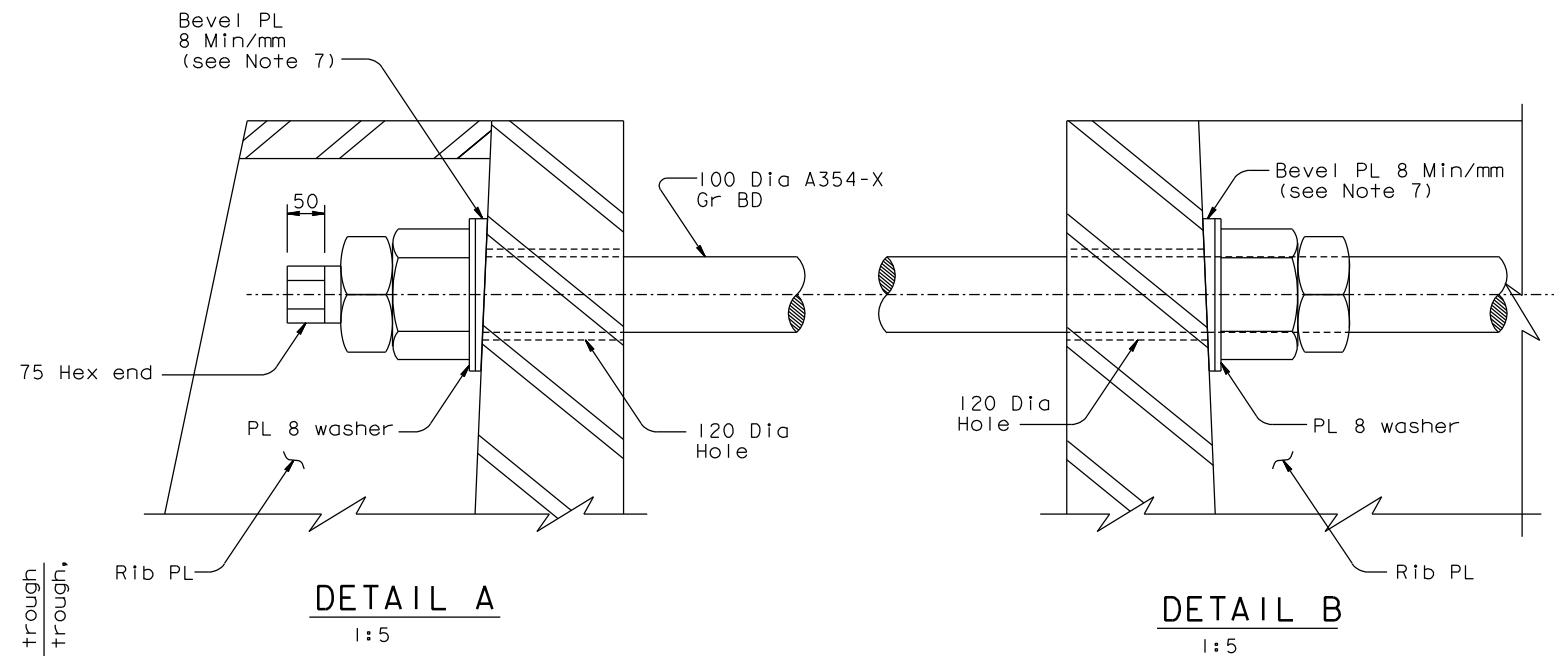
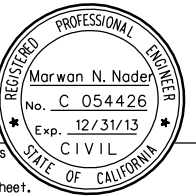
12-6-04

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

T.Y. LIN / MOFFATT & NICHOL  
825 BATTERY STREET  
SAN FRANCISCO, CA 94111

Caltrans now has a web site! To get to the web site, go to: <http://www.dot.ca.gov>



- NOTES:
- All dimensions in this sheet are shown in the plane normal to the cable center line, see "Tower Saddle Details No. 1" sheet.
  - The trough width, including all dividers and compartments, shall be 932 (tolerance +3, -3).
  - Divider plates shall be tapered 5% in grooves cut to permit tight insertion.
  - The height of the south cable trough varies in order to match the height of the north cable trough.
  - Wedged steel blocking layout shall be as shown on "Tower Saddle Details No. 5B" sheet. Steel shall be ASTM A572. All surfaces of steel shall be primed.
  - Surfaces of wedged steel plates against the divider plates shall have PTFE film (0.5 mm thick).
  - In lieu of the bevel PL, the Contractor may counterbore the casting up to 12 mm to form a level bearing surface for the nut and washer.
  - The tapered faces of the divider plates shall be placed facing the centerline of the bridge.
  - Prior to fabrication of new blocking, the Contractor shall measure as-built compartment widths. The blocking shall be fabricated to fit tightly at top and bottom within the as-built compartment dimensions.
  - At the Contractor's option, the steel blocking may be fabricated in several pieces. The taper of any piece shall not exceed 1:20. Provide adhesive between surfaces of blocking pieces.
  - Tower Saddle survey (see Detail D'):
    - Measure compartment width at top & bottom
    - Measure compartment depth
    - Measure at each blocking sections Type F & G
    - At each section, measure all 13 compartments
  - The completed blocking at each location is fabricated to fit tightly. Should tight fit not be achieved, the Contractor shall inform the Engineer for evaluation.

CONTRACT CHANGE ORDER NO. \_\_\_\_  
SHEET \_\_\_\_ OF \_\_\_\_

REQUESTS FOR INFORMATION NOT ADDRESSED IN THIS CCO REMAIN IN FORCE

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

SAN FRANCISCO OAKLAND BAY BRIDGE  
EAST SPAN SEISMIC SAFETY PROJECT  
SELF-ANCHORED SUSPENSION BRIDGE  
(SUPERSTRUCTURE & TOWER)

TOWER SADDLE DETAILS NO. 6

R. Valizadeh/V. Toan/Y. L. /W. L. /F. C.  
DESIGN OVERSIGHT  
Rev. Date: 5-18-98

MARK	DATE	DESCRIPTIONS	BY	CH'D	CCO#
Δ	05/07/12	SADDLE BLOCKING	GB	MN	240

DESIGN	BY M. Nader	CHECKED J. Kulik
DETAILS	BY L. Rus	CHECKED T. McMeans
QUANTITIES	BY L. Rus	CHECKED D. Harrison

PREPARED FOR THE  
STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

R. Manzanarez  
PROJECT ENGINEER

BRIDGE NO.  
34-0006L/R  
KILOMETER POST  
13.2/13.9

REVISION DATES (PRELIMINARY STAGE ONLY)	SHEET	OF
08/02/99 05/17/01 04/08/02 01/07/02 12/19/02 09/06/04 10/13/05	362R	1

ORIGINAL SCALE IN MILLIMETERS  
FOR REDUCED PLANS

CU 04  
EA 0120F1

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TIME PLOTTED => 11:02:23  
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DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
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REGISTERED ENGINEER - CIVIL

10-31-08

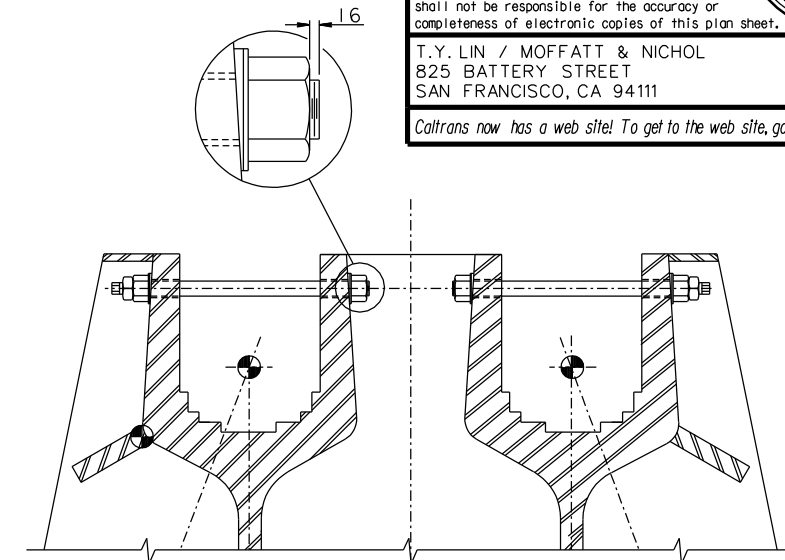
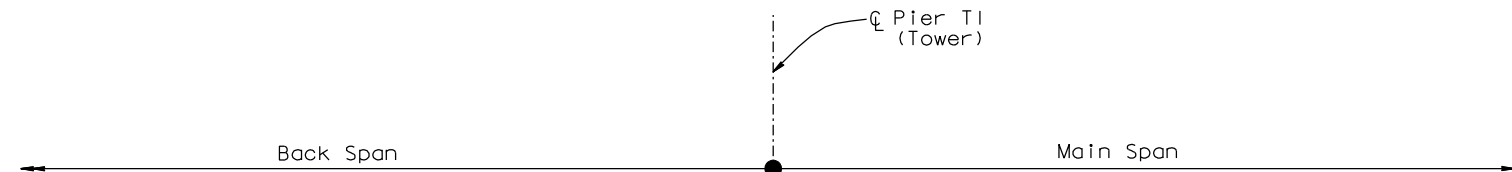
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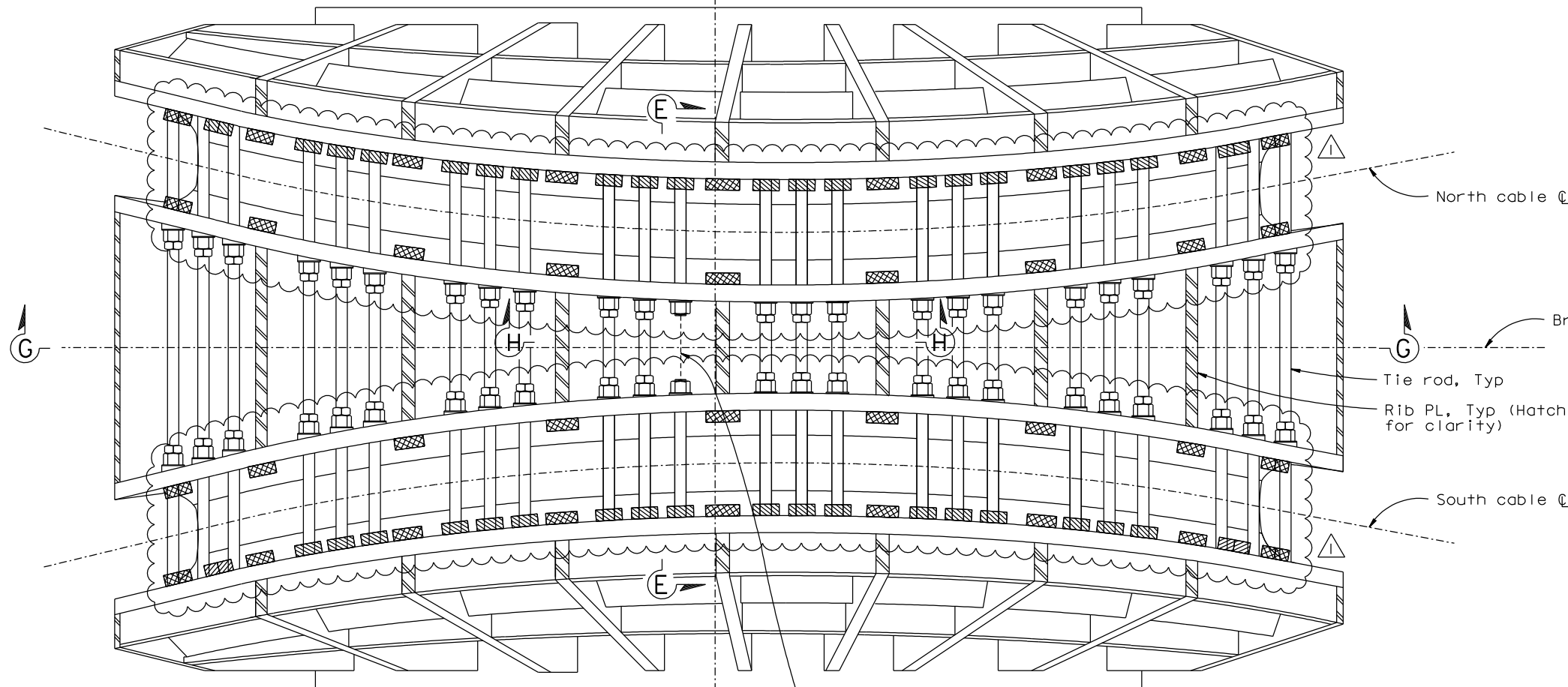
T.Y. LIN / MOFFATT & NICHOL  
825 BATTERY STREET  
SAN FRANCISCO, CA 94111

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PROFESSIONAL ENGINEER  
Marwan N. Nader  
No. C 054426  
Exp. 12/31/13  
CIVIL  
STATE OF CALIFORNIA



SECTION E-E (for details not shown, see Section A-A)  
1:25



LEGEND:

	Type F Blocking
	Type G Blocking

NOTES:

- For Section G-G, see "Tower Access Details No.23" sheet. For Section H-H, see "Tower Saddle Details No.5A" sheet.
- Tie rod is discontinuous between saddle troughs at this location only.
- For blocking, see "Tower Saddle Details No.6" sheet.

VIEW D-D  
1:25

CONTRACT CHANGE ORDER NO. \_\_\_\_  
SHEET \_\_\_\_ OF \_\_\_\_

REQUESTS FOR INFORMATION NOT ADDRESSED IN THIS CCO REMAIN IN FORCE

R. Valizadeh/V.Toan/Y.L./W.L./F.C.  
DESIGN OVERSIGHT  
Rev. Date: 5-18-98

MARK	DATE	DESCRIPTIONS	BY	CH'D	CCO#
1	05/07/12	SADDLE BLOCKING	GB	MN	240
2	10/31/08	TOWER HEAD DETAILS	NV	MN	93

DESIGN	BY	N. VO	CHECKED	M. Nader
DETAILS	BY	N. VO	CHECKED	M. Nader
QUANTITIES	BY	N. VO	CHECKED	M. Nader

PREPARED FOR THE  
STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

R. Manzanarez  
PROJECT ENGINEER

BRIDGE NO.
34-0006L/R
KILOMETER POST
13.2/13.9

SAN FRANCISCO OAKLAND BAY BRIDGE  
EAST SPAN SEISMIC SAFETY PROJECT  
SELF-ANCHORED SUSPENSION BRIDGE  
(SUPERSTRUCTURE & TOWER)  
TOWER SADDLE DETAILS NO.5B

CU 04  
EA 0120FI

DISCARD PRINTS BEARING  
EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 361S2R1 OF

FILE => I:\bb\04-012001\sas\contract plans and cco\cco\cco\*240\2-revision 05-07-12\dgn\agtsd05b.dgn

100% P&E  
DATE PLOTTED => 07 MAY 2012  
TIME PLOTTED => 15:42:03  
USERNAME => arivera

**DEPARTMENT OF TRANSPORTATION - District 4 Toll Bridge Program**

333 Burma Rd.  
Oakland, CA 94607  
(510) 622-5660, (510) 286-0550 fax



*Flex your power  
Be energy efficient!*

August 24, 2007

Contract No. 04-0120F4  
04-SF-80-13.2 / 13.9  
Self-Anchored Suspension Bridge  
Letter No. 05.03.01-000487

Michael Flowers  
Project Executive  
American Bridge/Fluor Enterprises, a JV  
375 Burma Road  
Oakland, CA 94607

Dear Michael Flowers,

**Department Audit of Dyson Corporation**

The Department has reviewed ABF letter 257, dated August 14, 2007, and the "Corrective Action Request" from the Dyson Corporation, dated August 09, 2007. Based upon the information provided and in accordance with Special Provisions section 8-4, "Audits," the Dyson Corporation receives a "Pass" for the Department audit. This "Pass" applies only to the Dyson Corporation. Suppliers and subcontractors to the Dyson Corporation are subject to separate MFSQA reviews and audits. The following table summarizes the current status of associated audits:

Company	Letter No.	Date of Notice	MFSQA	AUDIT
AAA Galvanizing	321	06-18-2007	Approved	
Art Galvanizing	336	06-22-2007	Approved	
	403	07-25-2007		Contingent Pass
Central Testing Lab	320	06-18-2007	Approved	
	413	07-26-2007		Fail
Custom Industrial Processing	325	06-18-2007	Not Approved	
Industrial Coatings Inc	444	08-06-2007	Approved	
Mechanical Galv-Plating Corp	361	07-05-2007	Approved	
	432	08-02-2007		Pass
North American Galvanizing	337	06-22-2007	Approved	
	421	07-31-2007		Fail
Stork Herron Testing Lab	297	06-06-2007	Approved	
	417	07-30-2007		Contingent Pass
TC Industries	367	07-09-2007	Approved	
Tensile Testing Metallurgical Lab	296	06-06-2007	Approved	
	409	07-26-2007		Pass
Universal Galvanizing	338	06-25-2007	Approved	



The Contractor is reminded that work may not proceed at the facilities receiving a "Contingent Pass," until the outstanding issues detailed in the Department's letters have been addressed.

If you have any further questions, please contact Gary Lai at the Working Drawing Campus.

Sincerely,



GARY PURSELL  
Resident Engineer

cc: Rick Morrow  
Mazen Wahbeh

file: 05.03.01, 55.0097

**DEPARTMENT OF TRANSPORTATION - District 4 Toll Bridge Program**

333 Burma Rd.

Oakland, CA 94607

(510) 622-5660, (510) 286-0550 fax

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July 09, 2008

Contract No. 04-0120F4

04-SF-80-13.2 / 13.9

Self-Anchored Suspension Bridge

Letter No. 05.03.01-002346

Michael Flowers  
Project Executive  
American Bridge/Fluor, A JV  
375 Burma Road  
Oakland, CA 94607

Dear Michael Flowers,

**Submittal 674, Rev. 1 - Monnig MFSQA (Response to Audit Contingencies)**

The Department has completed review of Submittal ABF-SUB-000674R01, "Monnig MFSQA," dated June 25, 2008, which contains the response to the audit contingencies in State Letter 05.03.01-002100. The submittal is "Approved," and Monnig Industries and Phoenix Manufacturing are receiving a Pass. It is acceptable for Monnig Industries to perform hot dip galvanizing of threaded anchor rods, with Phoenix Manufacturing performing abrasive blasting.

If you have any questions, please contact Dr. Venkatesh Iyer at (858) 967-6363.

Sincerely,

**<<< ORIGINAL SIGNED >>>**

GARY PURSELL  
Resident Engineer

cc: Rick Morrow  
Brian Boal  
Gary Lai  
Venkatesh Iyer  
file: 05.03.01, 55.0674



**DEPARTMENT OF TRANSPORTATION - District 4 Toll Bridge Program**

333 Burma Rd.  
Oakland, CA 94607  
(510) 622-5660, (510) 286-0550 fax



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February 13, 2009

Contract No. 04-0120F4  
04-SF-80-13.2 / 13.9  
Self-Anchored Suspension Bridge  
Letter No. 05.03.01-003482

Michael Flowers  
Project Executive  
American Bridge/Fluor, A JV  
375 Burma Road  
Oakland, CA 94607

Dear Michael Flowers,

**Submittal 135, Rev. 4 – MFSQA for Stork Herron Testing Laboratory (STHL)**

The Department has completed review of Submittal ABF-SUB-000135R04, "Manufacturing and Fabrication Self Qualification Audit (MFSQA) – Stork Herron Testing Laboratory," dated February 13, 2009. The submittal is "Approved," and accordingly, Mr. Shane Levermann may perform NDT (MT) on the Project for the Dyson Corporation.

If you have any questions, please contact Mohammad Fatemi (916) 813-3677.

Sincerely,

**<<< ORIGINAL SIGNED >>>**

GARY PURSELL  
Resident Engineer

cc: Rick Morrow  
Brian Boal  
Gary Lai  
Mohammad Fatemi  
file: 05.03.01, 55.0135

**DEPARTMENT OF TRANSPORTATION - District 4 Toll Bridge Program**

333 Burma Rd.

Oakland, CA 94607

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July 14, 2008

Contract No. 04-0120F4

04-SF-80-13.2 / 13.9

Self-Anchored Suspension Bridge

Letter No. 05.03.01-002360

Michael Flowers  
Project Executive  
American Bridge/Fluor, A JV  
375 Burma Road  
Oakland, CA 94607

Dear Michael Flowers,

**Quality Assurance Testing of Externally Threaded Fasteners**

This letter is issued in response to renewed discussions at the Working Drawing Campus (WDC) and ABF-RFI-001233R04, concerning the Quality Assurance (QA) testing regimen of externally threaded fasteners, nuts and washers (fastener assemblies) for the SAS Project.

Initial discussions concerning the QA sampling requirements took place at the WDC in June 2007 and predominately concentrated on the QA sampling quantity for specialized and large diameter fastener assemblies used on the Cable System and the E2 Bearing and Shear Keys. A spreadsheet quantifying the sample size was provided at that time in draft format for discussion purposes only.

In addition, the Contractor was reminded at these meetings that QA testing of fastener assemblies will be performed pursuant to Standard Specification Section 6-1.01, "Source of Supply and Quality of Materials," and that the sample quantity, per heat, will be in accordance with Contract Special Provision Section 10-1.59, "Steel Structures," subsection "Bolted Connections," as shown below:

Lot Size (No. of Bolts)	Sample Size (No. of Bolts)
2 to 15	3
16 to 25	4
26 to 50	5
51 to 90	7
91 to 150	8
151 to 280	9
281 to 10,000	12
10,001 to 500,000	16
500,001 and over	20



July 14, 2008

Page 2 of 2

The spreadsheet attached to this letter titled "*QA Sampling – Cable System/E2 Bearings & Shear Keys*," modifies the sample size provided above for some of the Cable System and E2 Bearing and Shear Key fastener assemblies. Please provide test samples in accordance with the attachment.

Please contact Brian Boal at (510) 622-5191 should you have any questions.

Sincerely,



GARY PURSELL  
Resident Engineer

Attachment

cc: Rick Morrow  
Brian Boal  
Mark Woods  
Gary Lai  
Venkatesh Iyer  
Ryan Smith  
file: 05.03.01

## QA Sampling - Cable System/E2 Bearings & Shear Keys

Description	Size	Material & Grade	Coating	Dwg Quantity Required	Spare Fasteners	Finished Item (Notes 10, 11, 12)	Material Only (Notes 10 & 13)	Comments
Cable Band Bolts	51mm dia x 610	A354 BC	HD Galv	1260		20	0	30 Bolts are required in addition to those listed in the table per Section 10-1.60 Cable System, for tensile testing & load extension curves
Cable Band Bolts	51mm dia x 710	A354 BC	HD Galv	48	T.B.D. by ABF	1	0	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Cable Band Anchor Rods	75mm dia x ###	A354 BD	HD Galv	24	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Tower Saddle Tie Rods	4" dia x ###	A354 BD	HD Galv	24	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
East Saddle Tie Rods	3" dia x ***	A354 BD	HD Galv	18	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
East Saddle Anchor Rods	50mm dia x ***	A354 BD	HD Galv	32	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
West Saddle Tie Rods	1.75" dia x ***	A354 BC	HD Galv	42	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
West Deviation Saddle Anchor Rods	50mm dia x ***	A354 BC	HD Galv	168	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Jacking Saddle Tie Rods	1.5" dia x ***	A354 BC	HD Galv	8	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Suspender Socket Anchor Rods - Type I	90mm dia x ***	A354 BC	HD Galv	352	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Suspender Socket Anchor Rods - Type II	100mm dia x ***	A354 BC	HD Galv	48	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Tower Suspender Anchor Rod	90mm dia x ***	A354 BC	HD Galv	16	T.B.D. by ABF	Included with Type I Suspender		
E2 Shear Key	76mm dia x **	A354 BD	HD Galv	192	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
E2 Shear Key	76mm dia x **	A354 BD	HD Galv	336	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
E2 Bearing	76mm dia x **	A354 BD	HD Galv	96	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
E2 Bearing	50mm dia x **	A354 BD	HD Galv	224	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.
Main Cable Anchor Rods	90mm dia x ###	A354 BD	HD Galv	274	T.B.D. by ABF	1	2	In all cases, three (3) samples per heat are required. At the Contractor's option, 3 full size finished items may be furnished.

### Notes/Legend:

1) Quantities for testing are per Lot. (Lot implies same diameter, length, heat, as well as heat treatment batch)

2) The number of samples indicated will be for Caltrans Lab testing.

3) Quantities listed do not take into account re-testing criteria due to failure

4) This list is NOT all inclusive. Items not listed are to follow the sampling size table in Section 10-1.59 "Steel Structures" of the Contract Special Provisions

5) ### = Fastener length varies; length to be determined by ABF's Means & Methods; \*\*\* = Fastener length to be determined by ABF's Means & Methods

6) A354 does not have metric equivalent. All Fastener diameters will be in Imperial. Those shown in Imperial were requested in RFI #278R0 & #281R1. Contract Plans - General Note allows for size substitution as clarified in RFI #65R0

7) ASTM A354 requires that the number of tests conform to ASTM F1470 and performed in accordance with ASTM F606

8) Number of tests/requirements for ASTM F1470 not shown

9) Quantities assume that no ROCAP testing required

10) Quantities provided are ONLY applicable if manufacturer passes Department Audit

11) Finished items shall be fabricated full-size; the Engineer will select one at random, and the fabricator may send to Trans Lab either this sample OR a 1200 mm length cut from a threaded end of the sample.

12) Each Finished item sample shall include the same number of washers, nuts, or similar components that will accompany an item's field installation.

13) "Material Only" denotes a sample 300 mm in length (minimum) which need not be threaded; it shall be from the same rod stock/heat treatment lots as the finished product.



# REQUEST FOR INFORMATION (RFI)

RFI No.: ABF-RFI-001233R04 Submitted By: Gatsos, Levi Pages: 1  
RFI Date: 23-June-2008 Contact Name: Kick, Robert Pages Attached: 0  
Phone No. (510) 808-4571

**Subject:** E2 Bearing and Shear Key Anchor Rod Spherical Washers

**References:**

**Sub/Sup:** DYS **Sub RFI #:**

**Response Required by:** 24-June-2008 **Response affects critical path activity?** Yes

**Description:**

Per WDC discussions, ABF understands the following;

1. The Proof Test Rod Assemblies are not required to be a part of a permanent heat treatment lot and that the heat treatment and galvanizing can be performed at any facility as long as it is in conformance with the contract requirements. Please confirm.
2. Caltrans would like additional QA samples to be provided for each heat treatment lot of E-2 Bearing and Shear Key Rods. Please provide details and quantity of additional samples per rod heat treatment lot.

**Contractor Disposition:**

This RFI is being submitted for:

The Cost and Time Impact from this RFI is: Cost and/or time impacts in the performance of our Work will result.

**Response:**

**Agreed Ext. Due Date:**

**Pages:** 1  
**Pages Attached:** 0

- 1) Contractor's proposal is acceptable.
- 2) For QA testing, the Contractor shall provide the following for each heat treated lot:  
3 – Nuts, washers, and plates  
1 – Test rod sample threaded 300mm on each end. Min.length of 1200mm  
2 – Material rod sample with minimum length of 300mm

The Department will issue a forthcoming letter clarifying QA sampling quantities for the job.

**Administrative Action:**

This response resolves the RFI.

**Date:** 25-June-2008

**Respondent:** Matin, Ron

**Phone No.:** 510-808-4611

**DEPARTMENT OF TRANSPORTATION - District 4 Toll Bridge Program**

333 Burma Rd.  
Oakland, CA 94607  
(510) 622-5660, (510) 286-0550 fax



*Flex your power  
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July 24, 2009

Contract No. 04-0120F4  
04-SF-80-13.2 / 13.9  
Self-Anchored Suspension Bridge  
Letter No. 05.03.01-004748

Michael Flowers  
Project Executive  
American Bridge/Fluor, A JV  
375 Burma Road  
Oakland, CA 94607

Dear Michael Flowers,

**Submittal 1179 - Saddle Tie Rod and Pipe Sleeve Drawings**

The Department has completed review of Submittal ABF-SUB-001179R00, "Saddle Tie Rod and Pipe Sleeve Drawings," dated June 1, 2009. The submittal is "Approved as Noted" as shown on the attached drawings and as outlined by the following comments:

**CATEGORY A:**

**1. Drawing JSW-TS-019:**

- a. Revise the length of the threads on the ASTM A490M bolts per the requirements of ANSI/ASME B18.2.3.7M.
- b. For the ASTM A490M bolts and A563M nuts, add the ANSI/ASME specifications for the metric threads.

**CATEGORY C:**

1. **Drawings JSW-DS-019, JSW-ES-012, JSW-JS-006:** For the A354 and A449 fasteners with bolt heads, the threaded lengths are longer than the standard lengths per ASME/ANSI B18.2.1, but they are acceptable by the ASTM requirements.

If you have any questions, please contact Brian Boal at (510) 622-5191.

Sincerely,

**<<< ORIGINAL SIGNED >>>**

GARY PURSELL  
Resident Engineer

Attachment

cc: Rick Morrow, Brian Boal, Gary Lai, Nina Choy  
file: 05.03.01, 55.1179



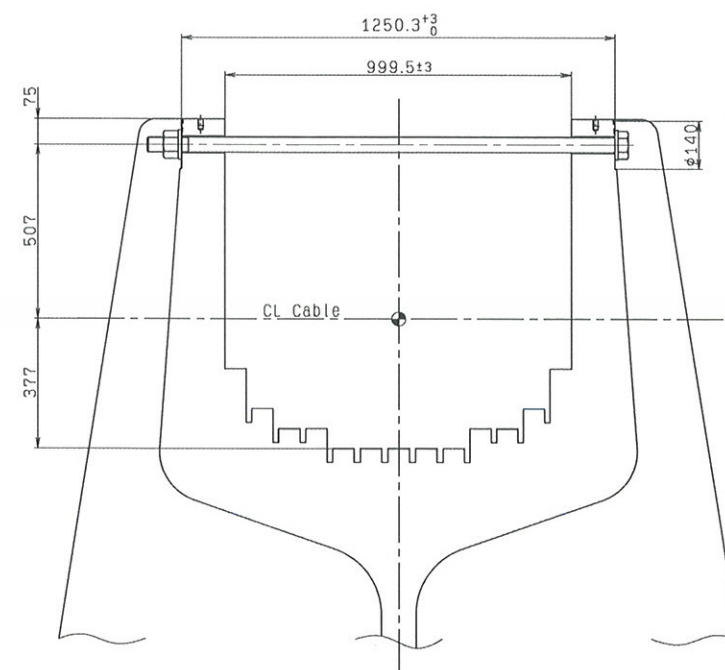
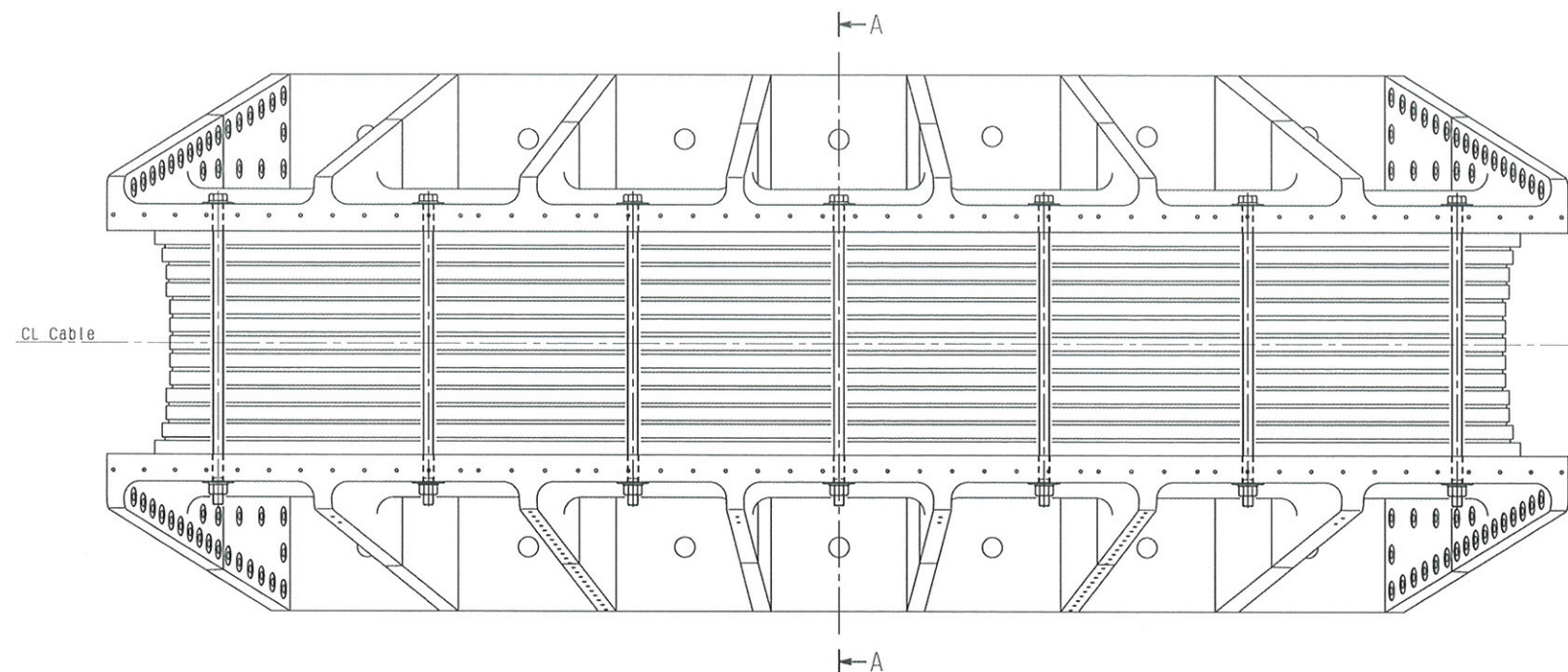
☒ APPROVED  
☐ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION

T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM

APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

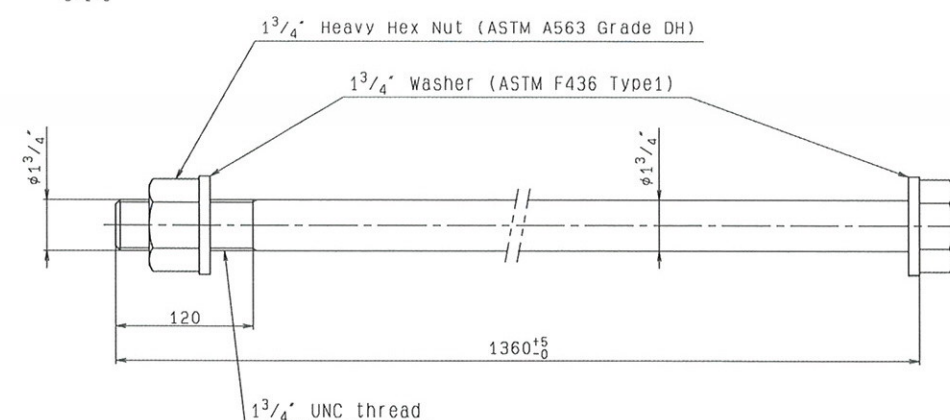
*mw*  
REVIEWED BY

DATE 06/24/09



SECTION A-A  
S=1:10

TIE ROD : 7sets (ASTM A354 Grade BC)  
S=1:3

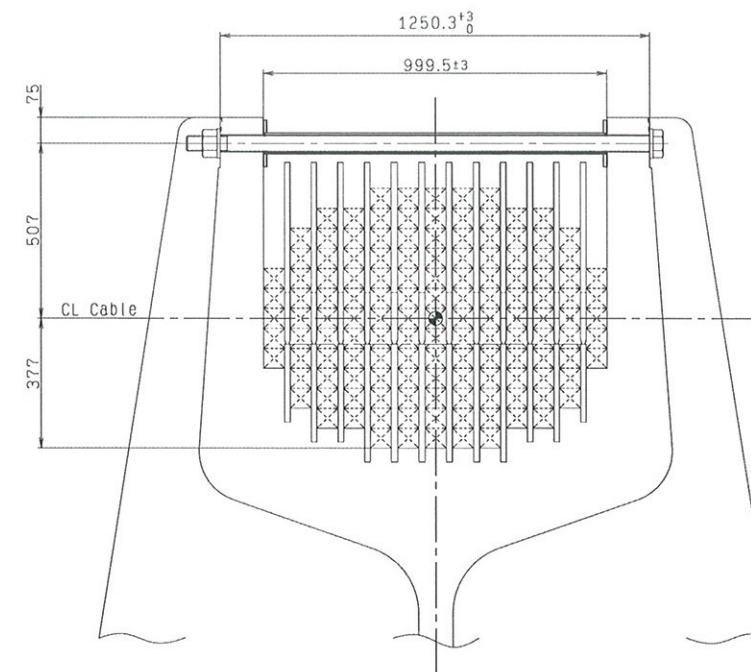
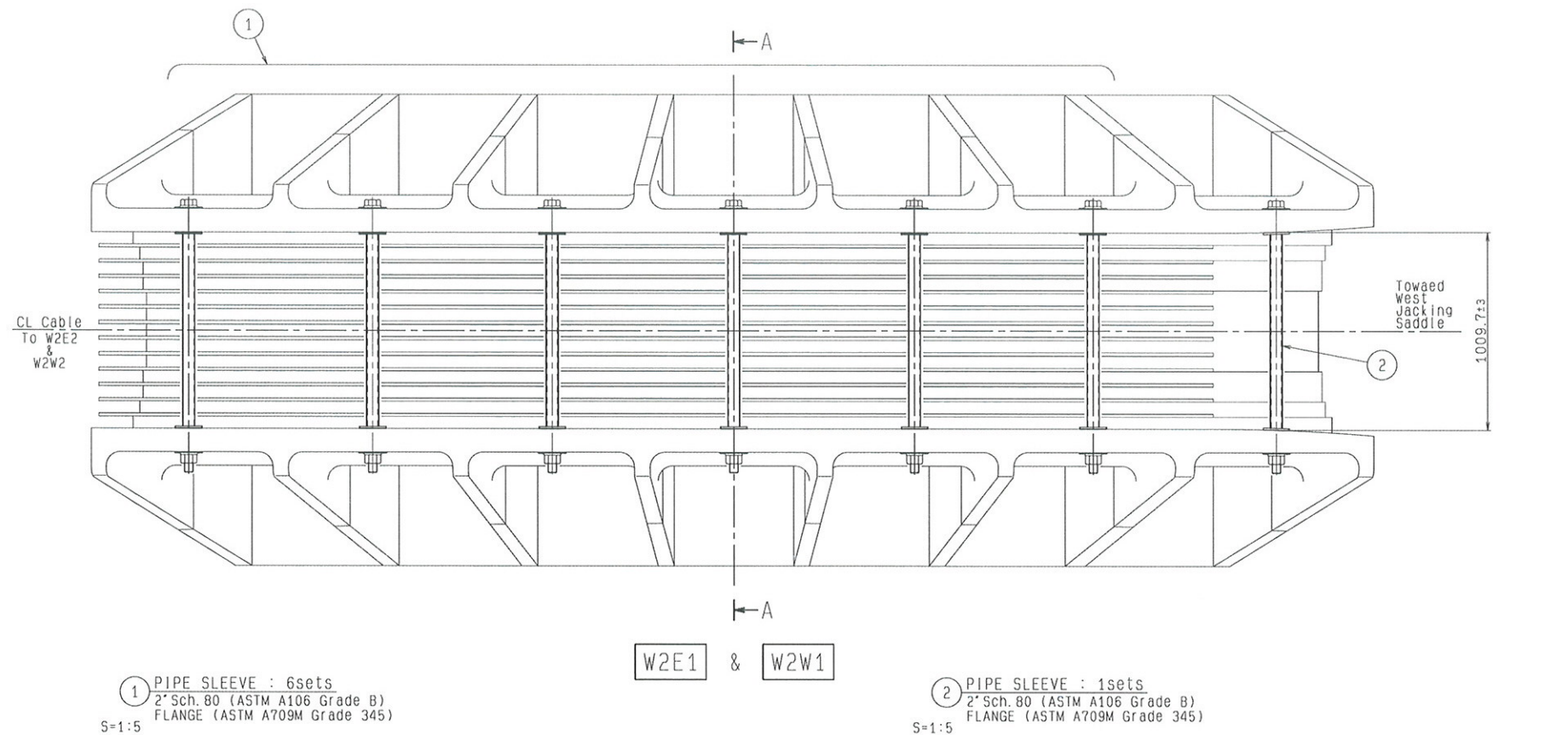


NOTES:

1. All dimensions are in millimeters unless otherwise shown.
2. Bolt nut and washer shall be hot dip galvanizing.
3. The thread dimension of bolts and nuts shall be according to applicable ANSI/ASME B1.1.
4. The tolerance of the bolt dimension shall be according to applicable ANSI/ASME B18.2.1.
5. The tolerance of the nuts and jam nuts dimension shall be according to applicable ANSI/ASME B18.2.2.
6. The tolerance of the thread dimension after galvanizing shall be conformed to the requirements in applicable ASTM A354, Para. 7.3.3.
7. The tolerance of the shank straightness shall be within 0.25% of shank length or within 2.5mm per 1m.
8. Tie Rods size and Nuts, Washers material are approved by ABF-RF1-278 R0, R1, -280 R0.

SAN FRANCISCO OAKLAND AND BAY BRIDGE		SEE DRAWING SCALE: 1" = 10'-0" APP'D: _____ CHK'D: _____ IN CHARGE: _____ DATE: _____
EAST SPAN BEISLM. RET. ROAD SELF-ANCHORED SUSPENSION BRIDGE DIVISION OF CALIFORNIA DEPARTMENT OF TRANSPORTATION CONTRACTING AMERICAN PORTLAND CEMENTS, INC., A JOINT VENTURE CONTRACT NO. 04-0150FA DATE OF ORDER: 04-01-50 ORDER NO. 04-0150-01 BRIDGE NO. 134-004E-01		
<p align="center"><b>WEST DEVIATION SADDLE</b></p> <p align="center"><b>TIE ROD</b></p> <p align="center"><b>DETAILS DRAWING</b></p> <p align="center">(FOR W21, W2E2 &amp; W2E3) (FOR W21, W2W2 &amp; W2W3)</p> <p>           P.O. BOX 101111 - 000159 JWS-DK-019            25W -00R 11-18-50         </p> <p align="center"><b>THE JAPAN STEEL WORKS, LTD. MUROGUN PLANT</b></p>		

REVISION				
REV. NO.	DATE	DESCRIPTION	PREP'D	CHK'D
1	13 Apr 2009	First Issue	K. TERADA	K. SATO



SECTION A-A  
Typical S=1:10

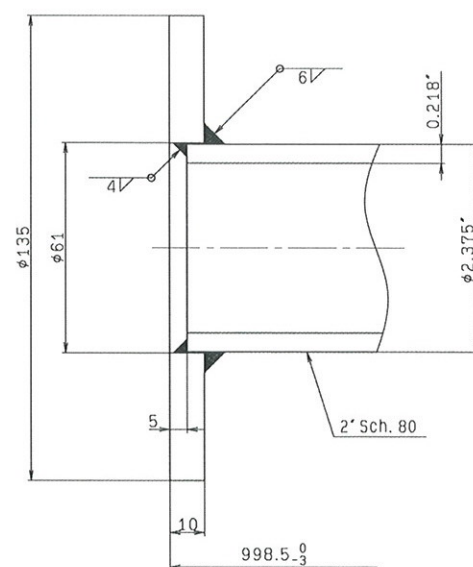
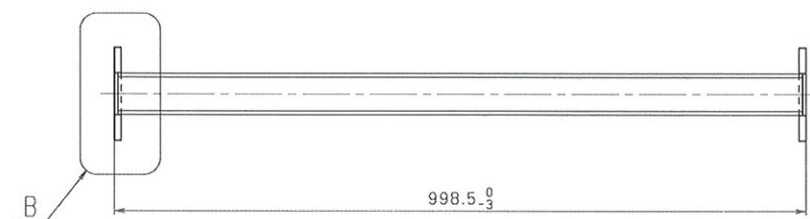
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<input checked="" type="checkbox"/> APPROVED AS NOTED
<input type="checkbox"/> RETURNED FOR CORRECTION

T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM

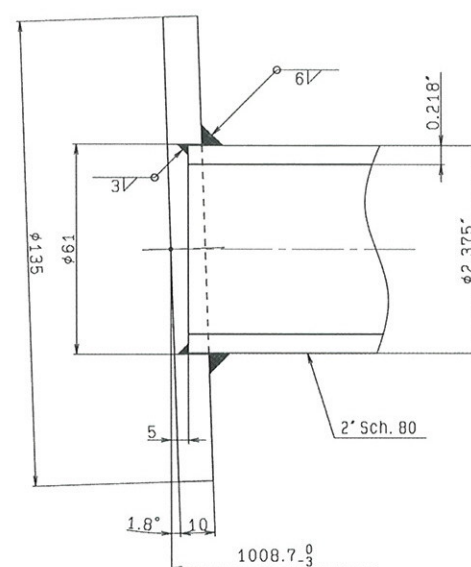
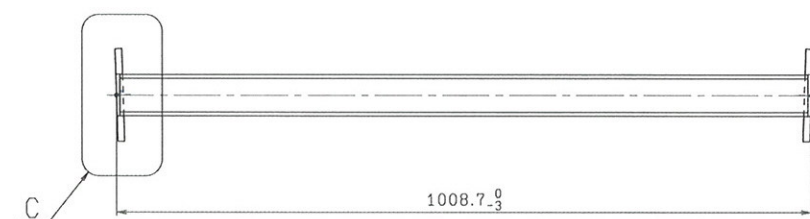
APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY: *[Signature]* DATE: 06/24/09

- NOTES:
- All dimensions are in millimeters unless otherwise shown.
  - Pipe Sleeve shall be hot dip galvanizing.
  - Detail Of Pipe Sleeve is approved by ABF-RF1-16 R.O.R. 1629



DETAIL B  
S=1:1

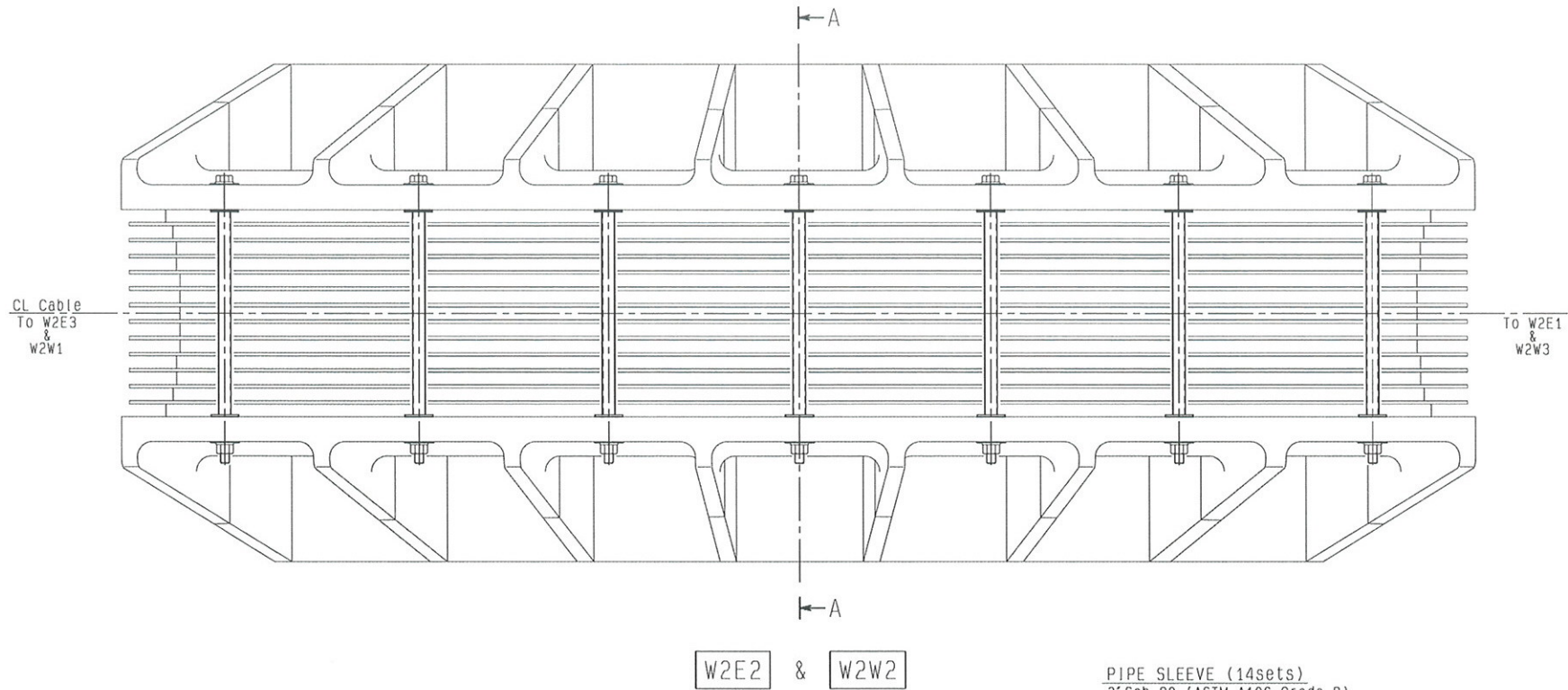


DETAIL C  
S=1:1

SAN FRANCISCO OAKLAND BAY BRIDGE EAST SPAN SEISMIC RETROFIT PROJECT SELF-ANCHORED SUSPENSION BRIDGE	
OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	
CONTRACTOR: AMERICAN BRIDGE/FLOOR ENTERPRISES, INC. - A JOINT VENTURE	
CONTRACT NO. 80-8120F4	
ROUTE NO. 84-SF-RS-13, 2713.6	
BRIDGE NO. 134-5006L/P2	
WEST DEVIATION SADDLE PIPE SLEEVE DETAILS DRAWING (FOR W2E1 & W2W1)	
SCALE: 1:15 APP'D: K. SATO CHK'D: M. YAMAMOTO DRAWN: K. TERADA	
P.O. NO. 1080110-SA-005175W DWG. NO. 1080110-SA-005175W-01 DATE: 13 Apr 2009	
THE JAPAN STEEL WORKS, LTD. MURORAN PLANT STEEL PRODUCTS REP. SF088 P.J.T.	



REVISION					
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	13 APR 2009	First Issue	A. TERADA	M. YAMAMOTO	K. SATO



☐ APPROVED  
☒ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION

T-Y LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM

APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY

06/24/09

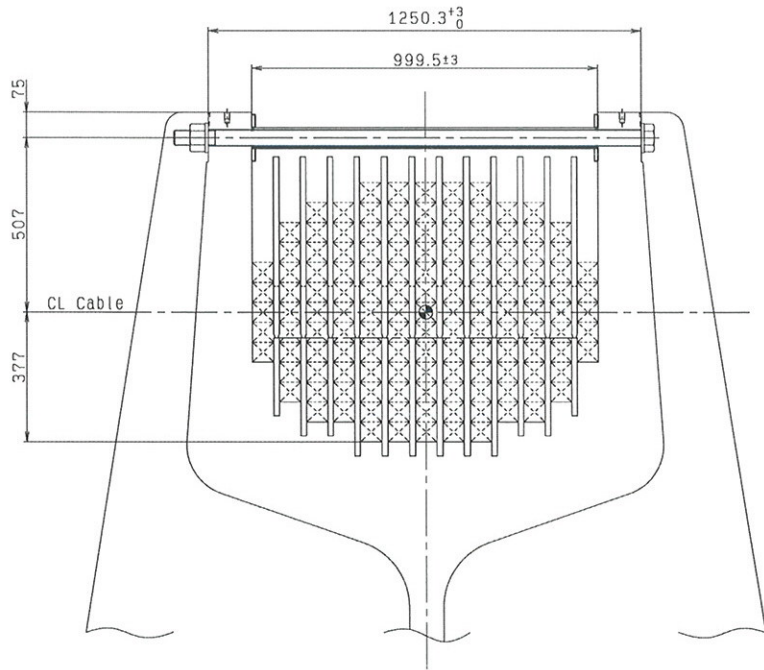
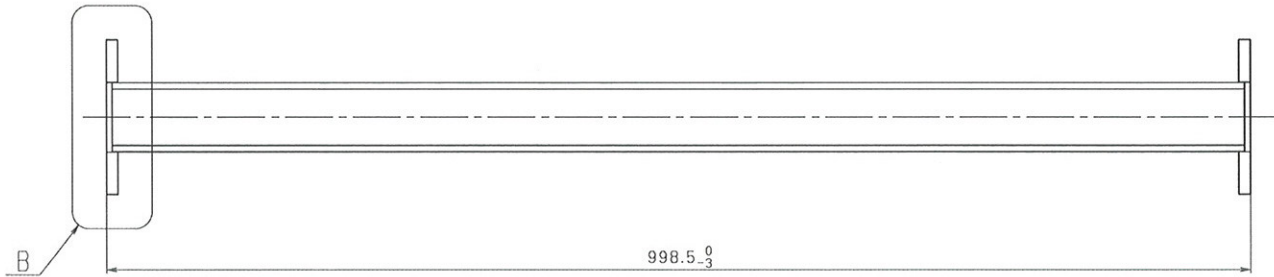
DATE

PIPE SLEEVE (14sets)

2" Sch. 80 (ASTM A106 Grade B)

FLANGE (ASTM A709M Grade 345)

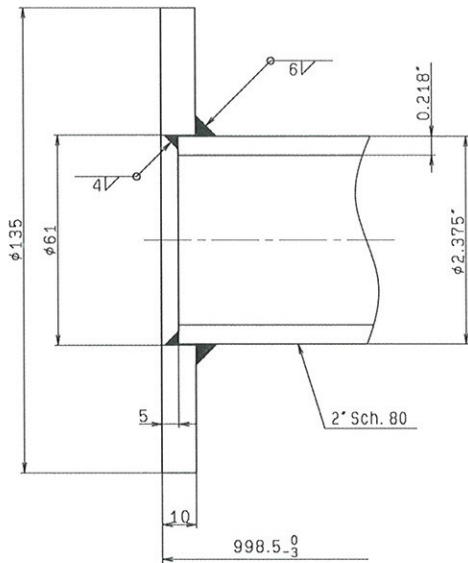
S=1:3



SECTION A-A

Typical

S=1:10



DETAIL B

S=1:1

- NOTES:
1. All dimensions are in millimeters unless otherwise shown.  
2. Pipe Sleeve shall be hot dip galvanizing.  
3. Detail OF Pipe Sleeve is approved by ABF-RF1-16 RO.R1
- 1629

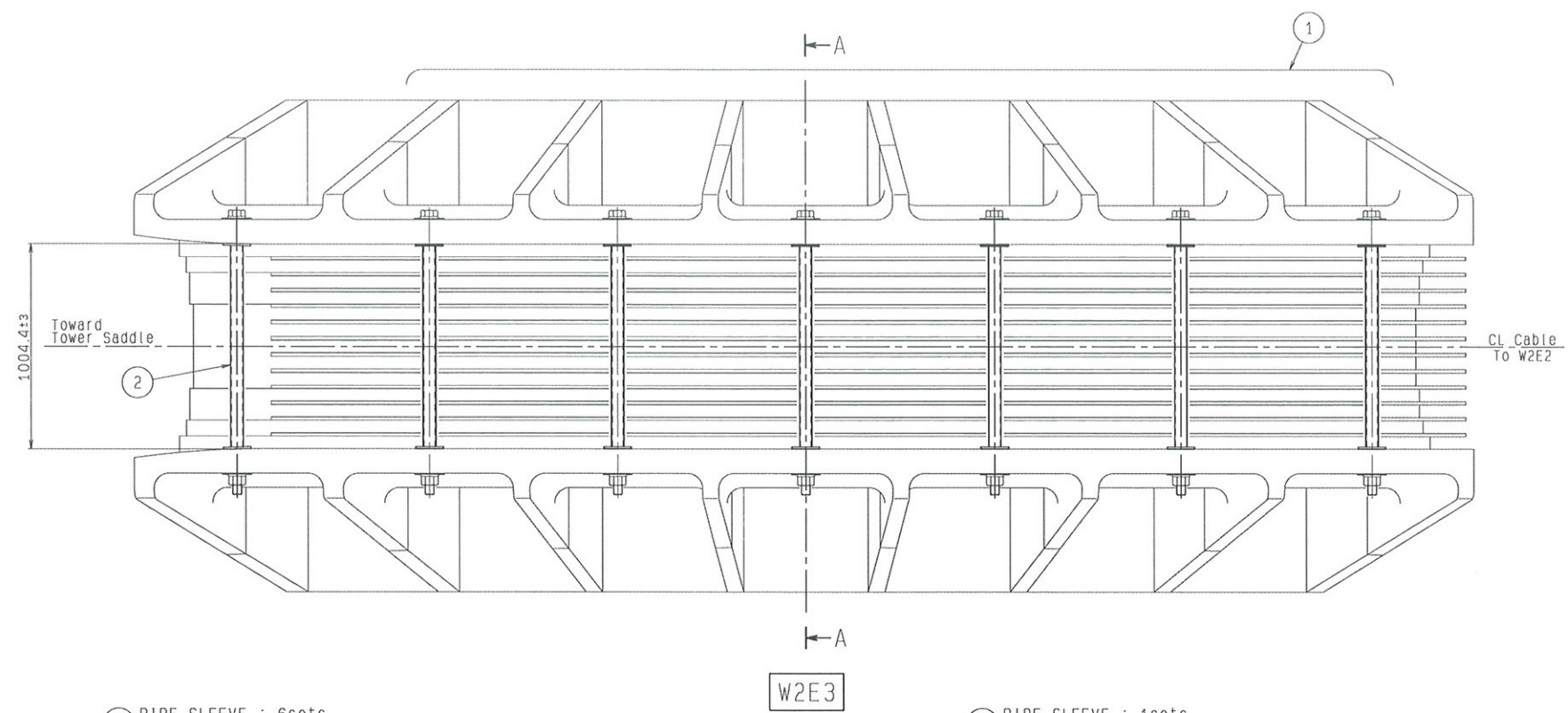
SAN FRANCISCO OAKLAND BAY BRIDGE  
EAST SPAN SEISMIC RETROFIT PROJECT  
SELF-ANCHORED SUSPENSION BRIDGE  
OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION  
CONTRACTOR: AMERICAN BRIDGE/FLOOR ENTERPRISES INC., A JOINT VENTURE  
CONTRACT NO.: 10-00137A  
ROUTE NO.: 101-SP-05-13, 2713, 9  
BRIDGE NO.: 101-0001/2

WEST DEVIATION SADDLE  
PIPE SLEEVE  
DETAILS DRAWING  
(FOR W2E2 & W2W2)

NO. 101-0001/2  
SCALE: 1:15  
APP'D: K. SATO  
CHK'D: M. YAMAMOTO  
DRAWN: H. TERADA

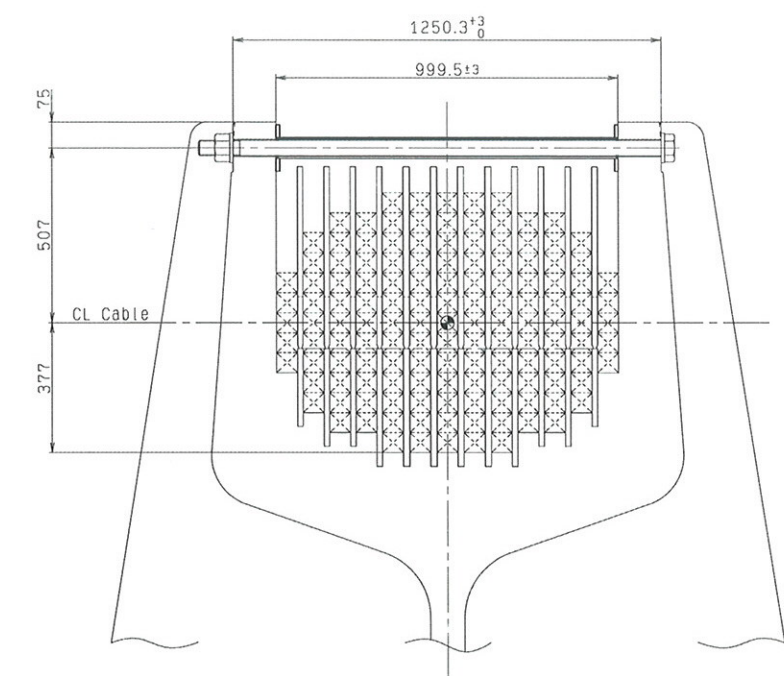
P.O. NO.: 101-00110-1A-0001/2 SW DWG. NO.: 101-00110-1A-0001/2  
REV. DATE: 13 APR 2009  
JST: JST NO.: 101-00110-1A-0001/2 JST: JST NO.: 101-00110-1A-0001/2  
THE JAPAN STEEL WORKS LTD. MIYORAN PLANT  
STEEL PRODUCTS DEP. SF08R PWT

REVISION					
REV. NO.	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	13.Apr.2009	First Issue	K. TERADA	M. YAMAMOTO	K. SATO

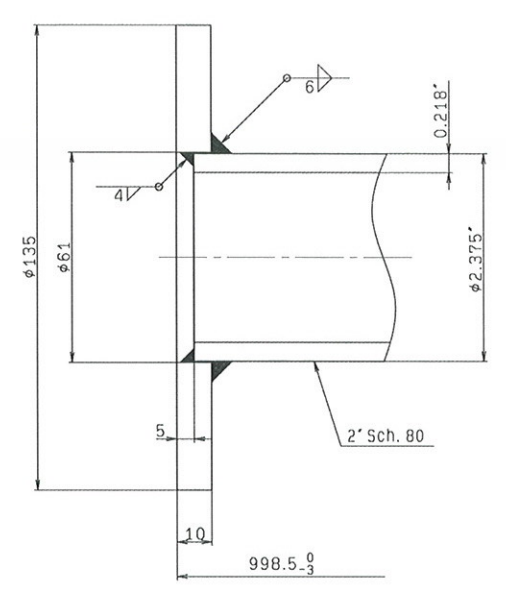
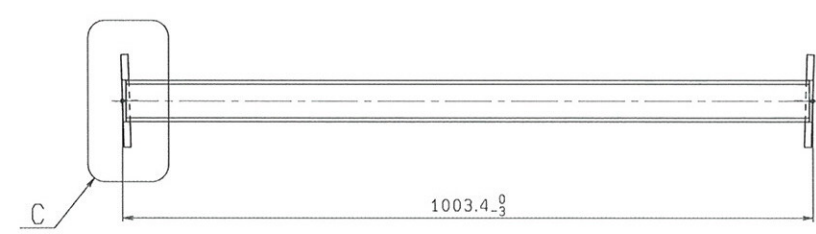
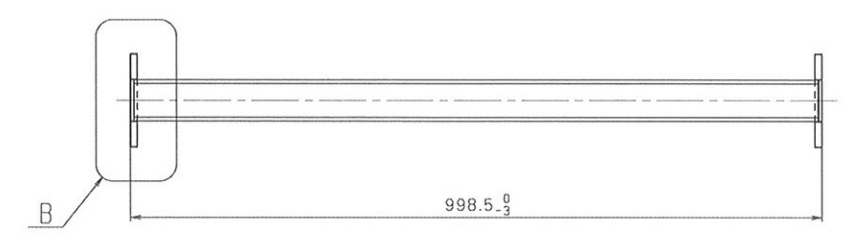


① PIPE SLEEVE : 6sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5

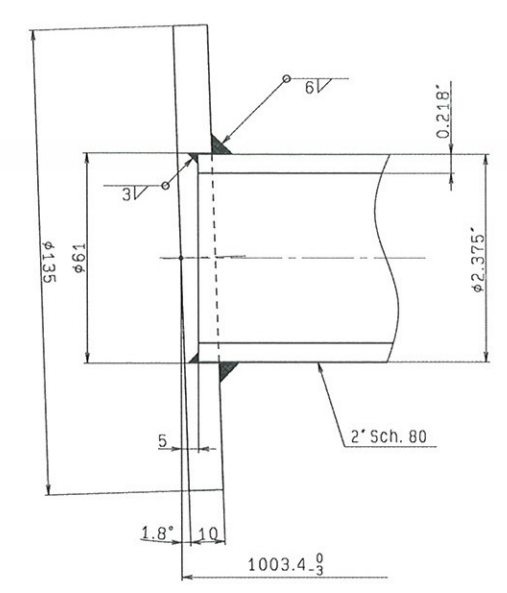
② PIPE SLEEVE : 1sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5



SECTION A-A  
Typical S=1:10



DETAIL B  
S=1:1



DETAIL C  
S=1:1

☐ APPROVED  
☒ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION

T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM


APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY: *[Signature]* DATE: 06/24/09

NOTES:

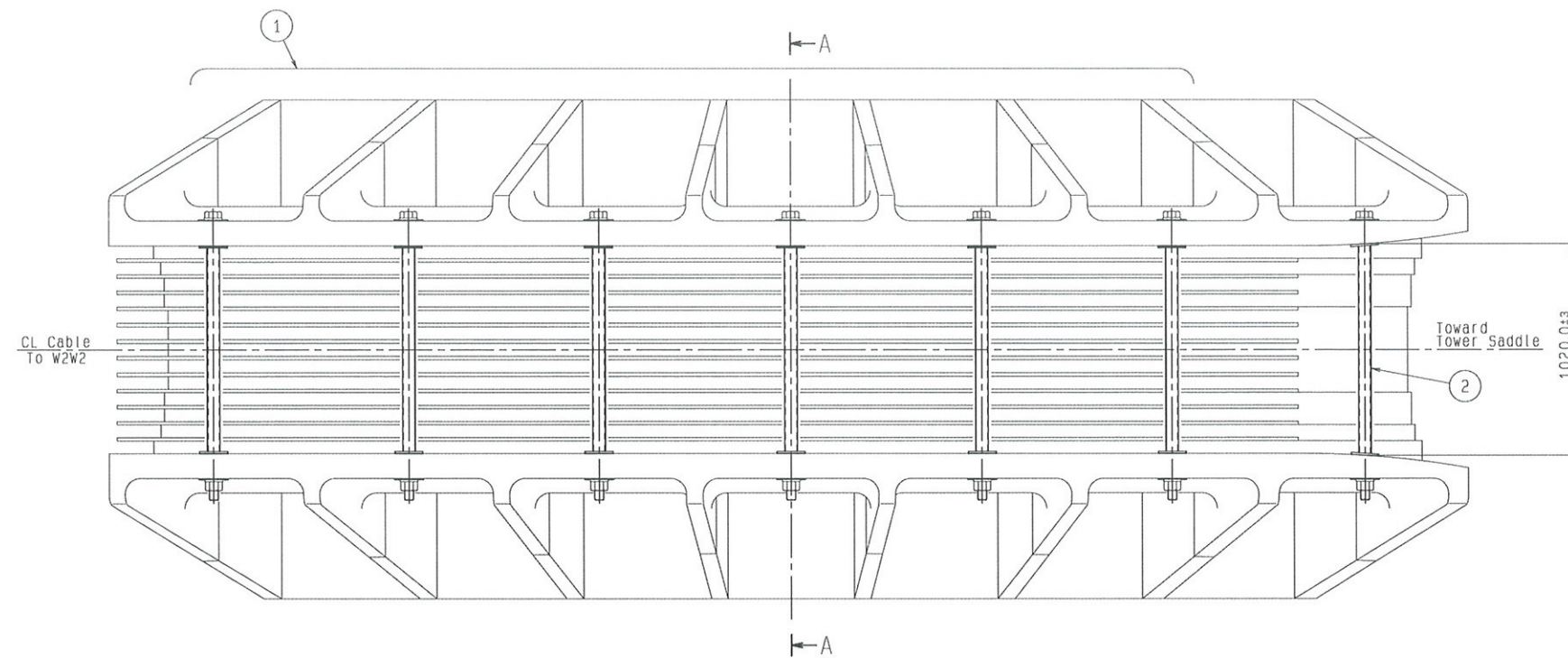
1. All dimensions are in millimeters unless otherwise shown.
2. Pipe Sleeve shall be hot dip galvanizing.
3. Detail Of Pipe Sleeve is approved by ABF-RFI-16 RO. R1.

1629

SAN FRANCISCO OAKLAND BAY BRIDGE EAST SPAN SEISMIC RETROFIT PROJECT SELF-ANCHORED SUSPENSION BRIDGE			
OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION			
CONTRACTOR: AMERICAN BRIDGE/FLUOR ENTERPRISES INC. - A JOINT VENTURE			
CONTRACT NO.: 100-01207			
ROUTE NO.: 100-01207-13, 2713.9			
BRIDGE NO.: 100-000122			
<u>WEST DEVIATION SADDLE</u>		S&B ANAL. PROJECT SCALE:  1:15	
<u>PIPE SLEEVE</u>		APP'D: K. SATO	
<u>DETAILS DRAWING</u>		CHK'D: M. YAMAMOTO	
(FOR W2E3)		DRAWN: K. TERADA	
P.O. NO.: 1000110-SA-000175W DWG. NO.: 100-01207-13, 2713.9		REV. DATE: 13.Apr.2009	
THE JAPAN STEEL WORKS, LTD. MURORAN PLANT			
STEEL PRODUCTS DEPT. SF08B PJT			

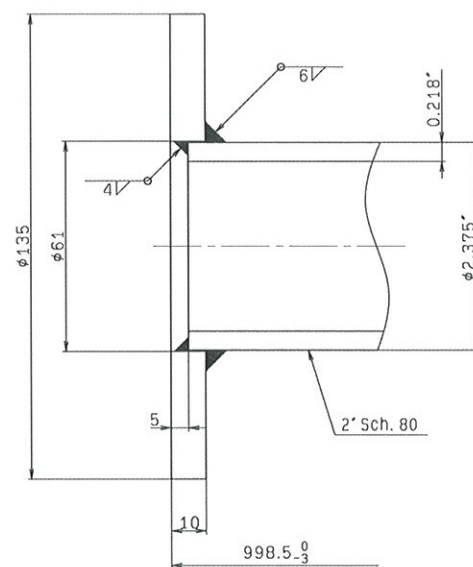
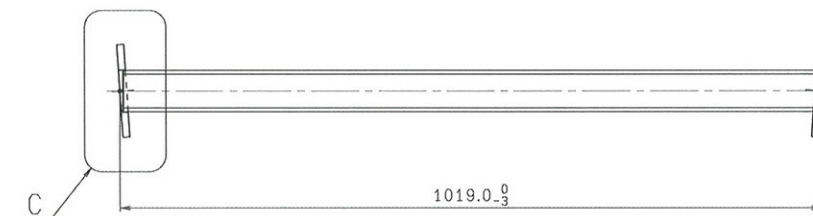
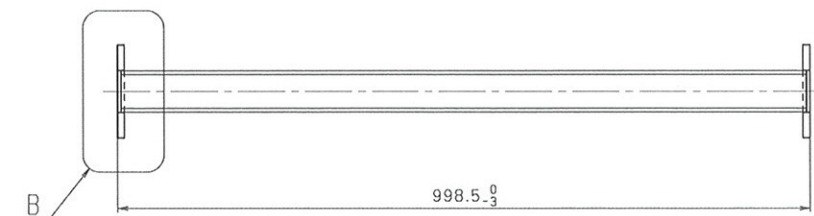


REVISION					
REV	DATE	DESCRIPTION	PREP	CHK	APP'D
1	13 APR 2009	FIRST ISSUE	K. TERADA	M. YAMAMOTO	K. SATO



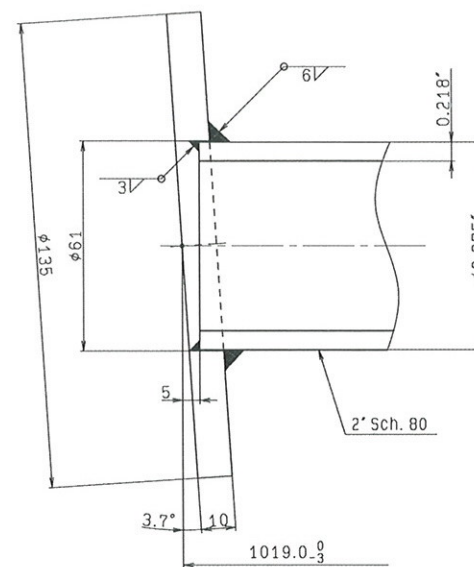
① PIPE SLEEVE : 6sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5

② PIPE SLEEVE : 1sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5



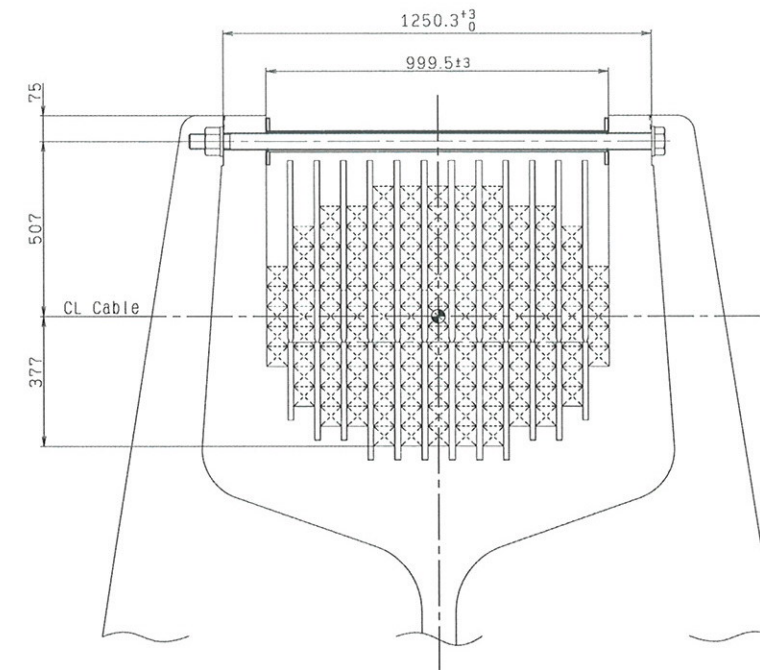
DETAIL B

S=1:1



DETAIL C

S=1:1



SECTION A-A

Typical

S=1:10

☐ APPROVED  
☒ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION

T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM

APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY: *[Signature]* DATE: 06/24/09

NOTES:

1. All dimensions are in millimeters unless otherwise shown.
2. Pipe Sleeve shall be hot dip galvanizing.
3. Detail of Pipe Sleeve is approved by ADF-RF1-16 R0-R1.

1629

SAN FRANCISCO OAKLAND BAY BRIDGE  
EAST SPAN SEISMIC RETROFIT PROJECT  
SELF-ANCHORED SUSPENSION BRIDGE

OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

CONTRACTOR: AMERICAN BRIDGE/FLOOR ENTERPRISES, INC. - A JOINT VENTURE

CONTRACT NO.: 04-01204

ROUTE NO.: 104-15-05-13-0713.0

BRIDGE NO.: 34-000874

WEST DEVIATION SADDLE  
PIPE SLEEVE  
DETAILS DRAWING  
(FOR W2W3)

SCALE: 1:15

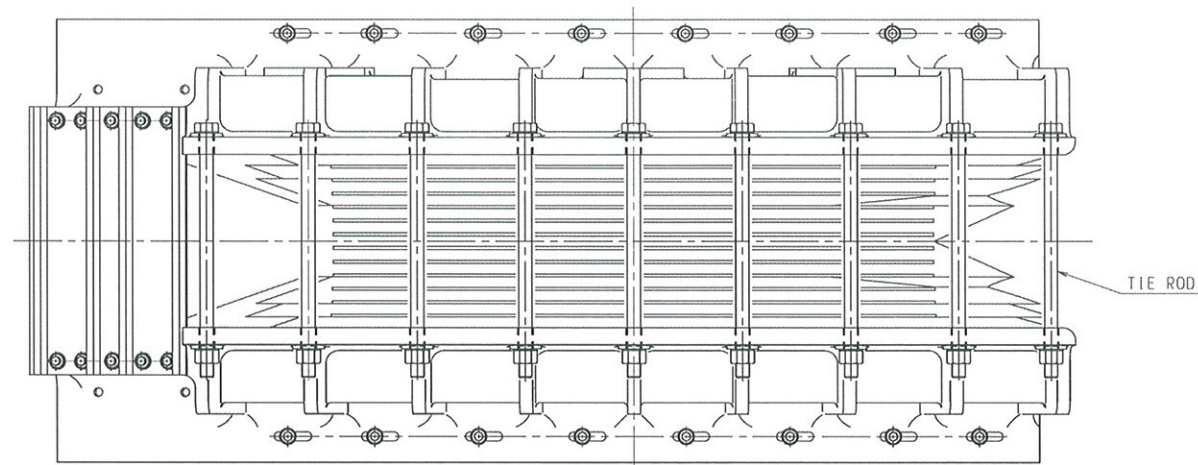
APP'D: K. SATO  
CHK'D: M. YAMAMOTO  
DRAWN: H. TERADA

P.O. NO.: 1080110-SA-00515W DWG. NO.: 1080110-SA-00515W-020-0  
JWS-JS-020-0  
13 APR 2009

THE JAPAN STEEL WORKS, LTD. MURORAN PLANT  
STEEL PRODUCTS DEP. SF08R.P41

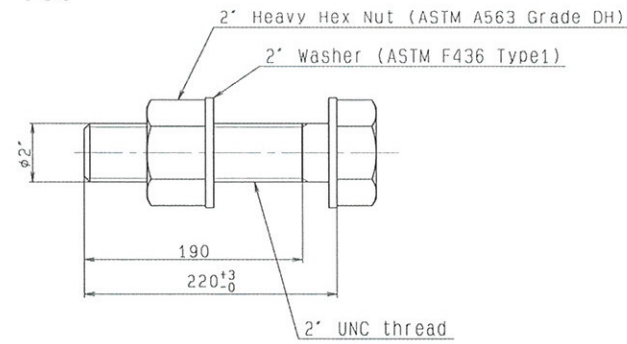


REVISION				
REV	DATE	DESCRIPTION	PREP	CHK'D
1	14 APR 2009	First Issue	K. SATO	K. SATO



BOLT, NUT : 10sets (ASTM A449)

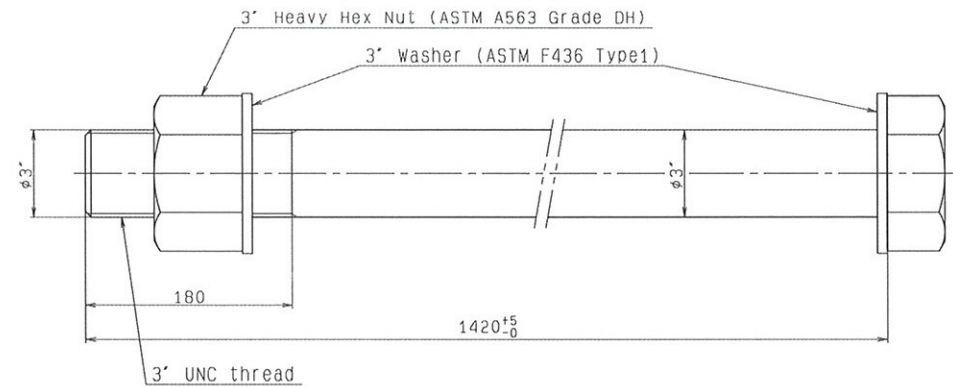
S=1:3



☒ APPROVED  
☐ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION  
 T.Y. LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
 THE EAST SPAN BRIDGE DESIGN TEAM  
 APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
 STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
 DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
 SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
 5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.  
 REVIEWED BY: [Signature] DATE: 06/24/09

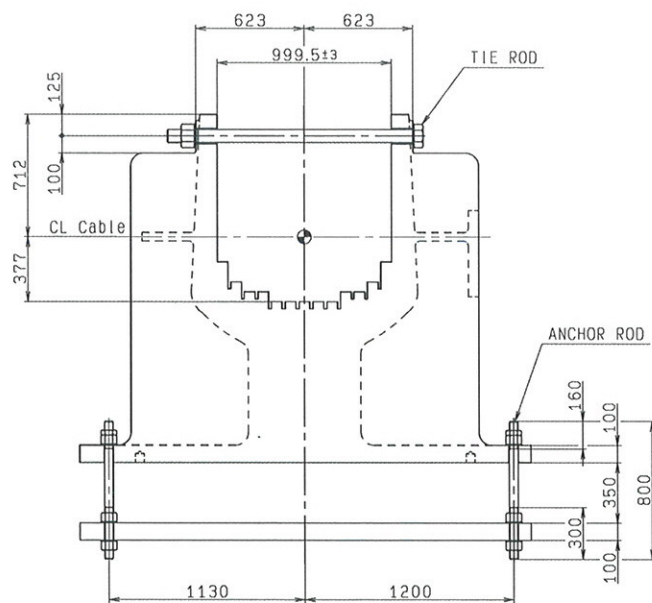
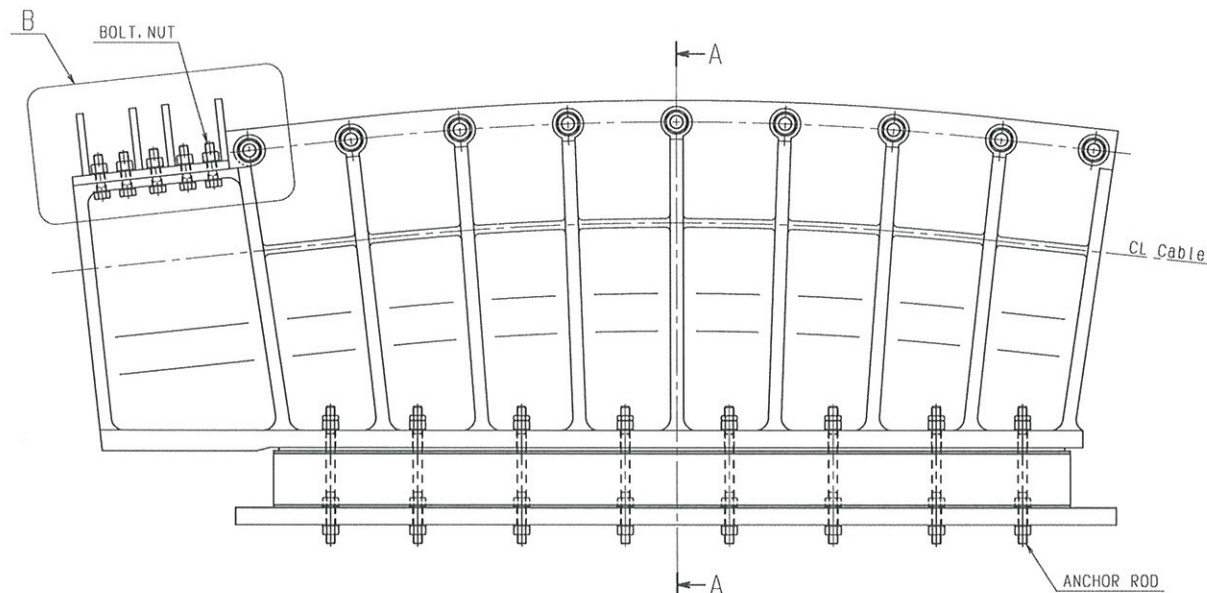
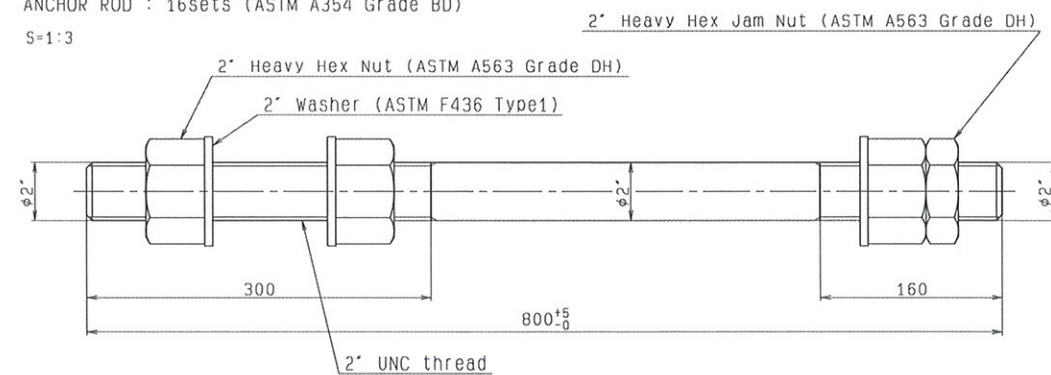
TIE ROD : 9sets (ASTM A354 Grade BD)

S=1:3



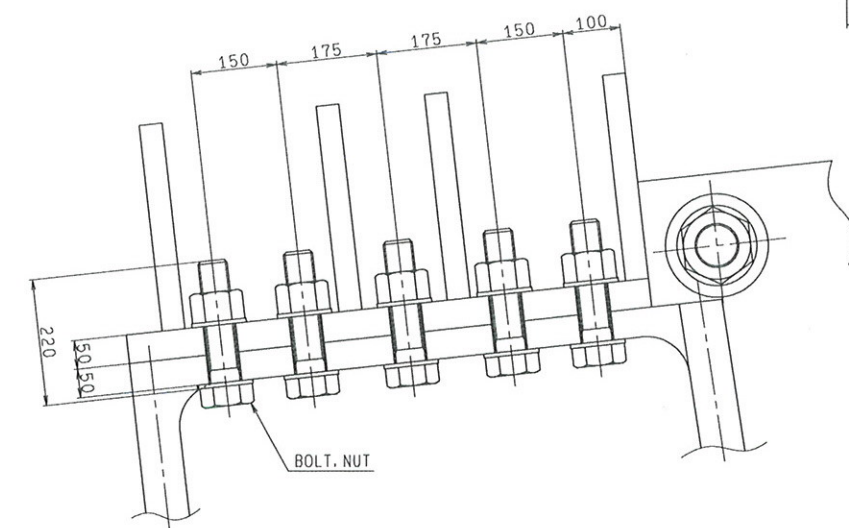
ANCHOR ROD : 16sets (ASTM A354 Grade BD)

S=1:3



SECTION A-A

S=1:20



DETAIL B

S=1:6

NOTES:

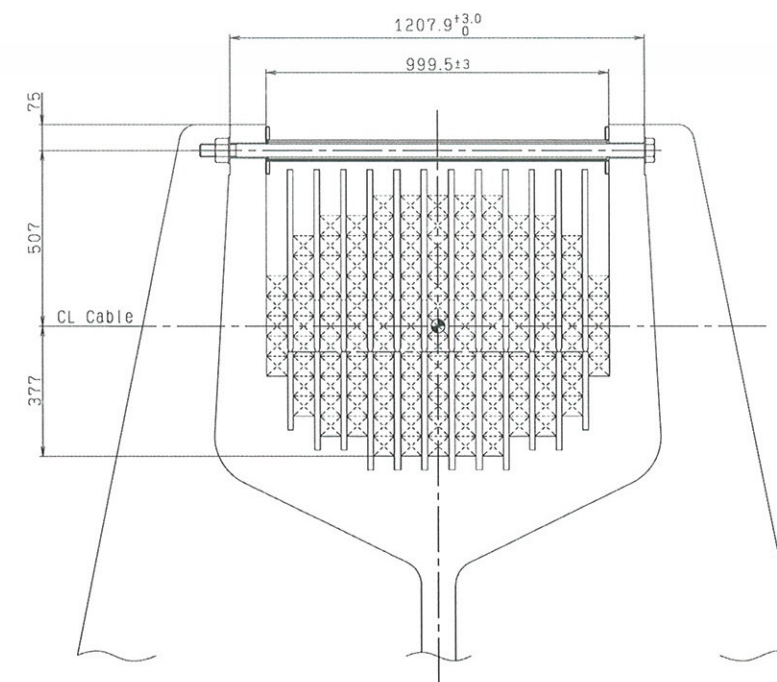
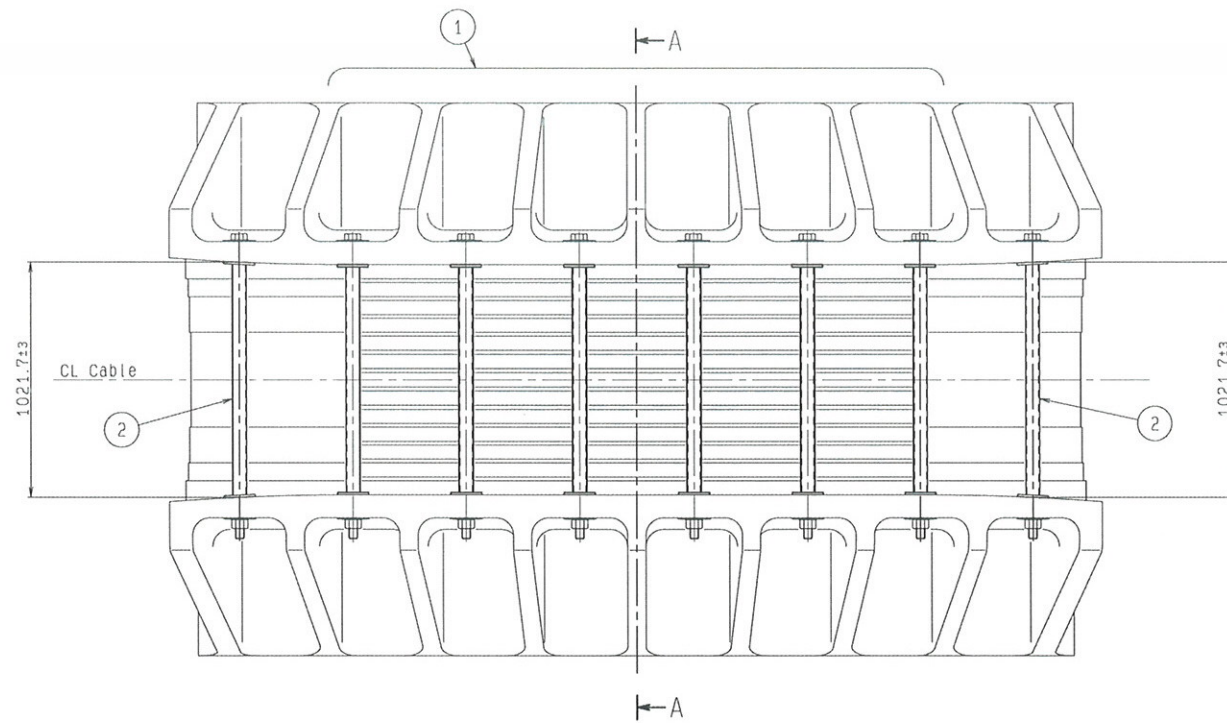
1. All dimensions are in millimeters unless otherwise shown.
2. Bolt nut and washer shall be hot dip galvanizing.
3. The thread dimension of bolts and nuts shall be according to applicable ANSI/ASME B1.1.
4. The tolerance of the bolt dimension shall be according to applicable ANSI/ASME B18.2.1.
5. The tolerance of the nuts and jam nuts dimension shall be according to applicable ANSI/ASME B18.2.2.
6. The tolerance of the thread dimension after galvanizing shall be conformed to the requirements in applicable ASTM A354, Para. 7.3.3.
7. The tolerance of the shank straightness shall be within 0.25% of shank length or within 2.5mm per 1m.
8. Tie Rods size and Nuts, Washers material are approved by ABF-RF1-276 R0, R1, -280 R0.
9. Bolts size of ASTM A449 and Anchor Rods size of ASTM A354 Grade BD are approved by ABF-RF1-26 R0.
10. Detail of Anchor Rod (ASTM A354 Grade BD) is approved by ABF-RF1-1459 R0.

SAN FRANCISCO OAKLAND BAY BRIDGE	
EAST SPAN SEISMIC RETROFIT PROJECT	
SELF-ANCHORED SUSPENSION BRIDGE	
OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	
CONTRACTOR: AMERICAN BRIDGE/FLOR ENTERPRISES INC., A JOINT VENTURE	
CONTRACT NO.: 04-0209A	
BRIDGE NO.: 04-0209A-13 2713.9	
EAST SADDLE	
TIE ROD & ANCHOR ROD & BOLT, NUT	
DETAILS DRAWING	
(FOR E2E1 & E2W1)	
P.O. NO.: 180110-SA-00515W	REV. DATE
APP. NO.: 180110-SA-00515W	APP. DATE
THE JAPAN STEEL WORKS, LTD. MIYORAN PLANT	
STEEL PRODUCTS REP. SE088 P.V.T.	





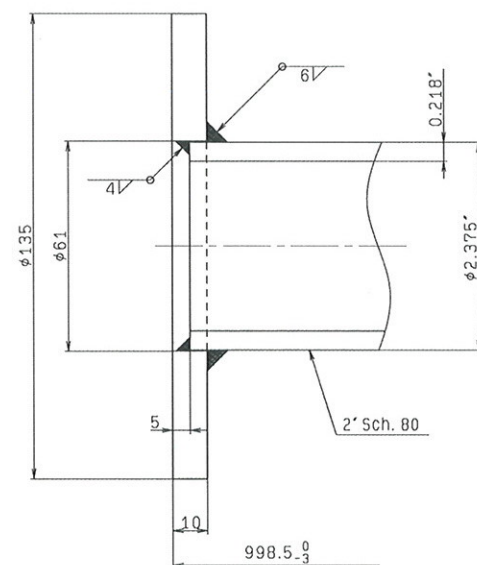
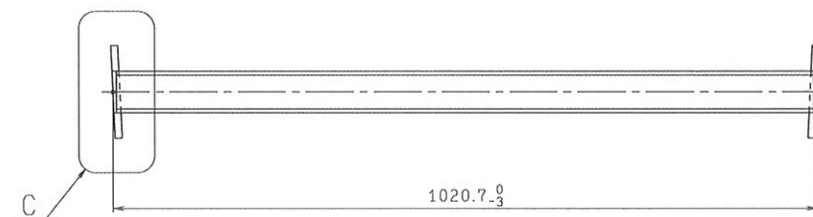
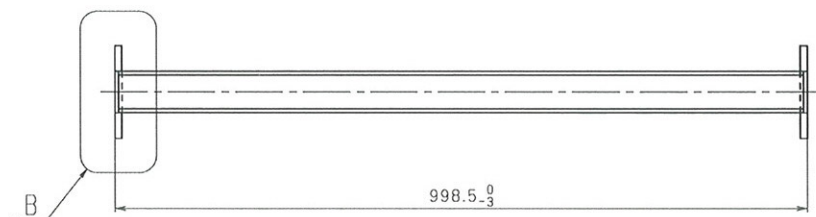
REVISION					
REV	DATE	DESCRIPTION	PREP	CHK	APP'D
1	13 APR 2009	FIRST ISSUE	A. TERADA	M. YAMAMOTO	K. SATO



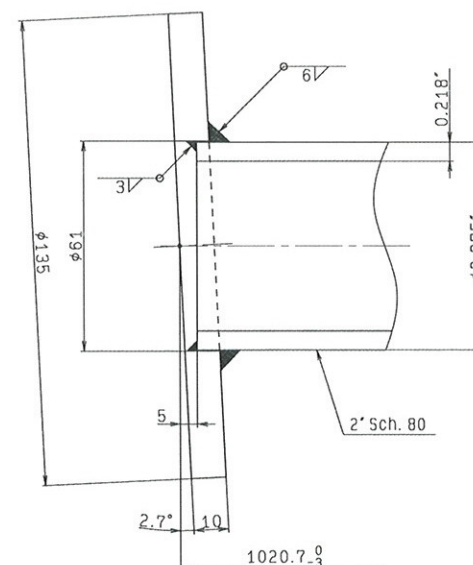
SECTION A-A  
Typical S=1:10

① PIPE SLEEVE : 6sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5

② PIPE SLEEVE : 2sets  
2" Sch. 80 (ASTM A106 Grade B)  
FLANGE (ASTM A709M Grade 345)  
S=1:5



DETAIL B  
S=1:1



DETAIL C  
S=1:1

☐ APPROVED  
☒ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION

T·Y·LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
THE EAST SPAN BRIDGE DESIGN TEAM

APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY: *[Signature]* DATE: 06/24/09

NOTES:

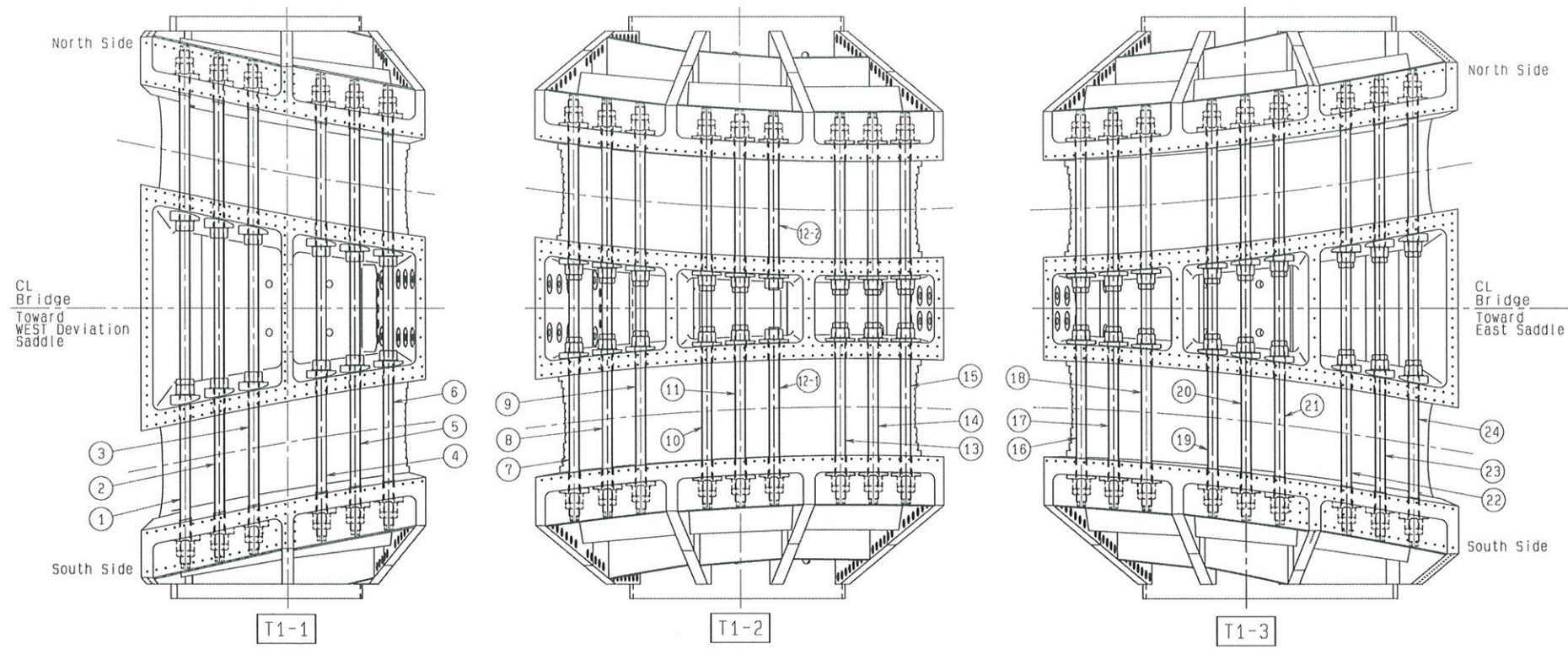
- All dimensions are in millimeters unless otherwise shown.
- Pipe Sleeve shall be hot dip galvanizing.
- Detail of Pipe Sleeve is approved by ABF-RF1-16 RO-R1

1629

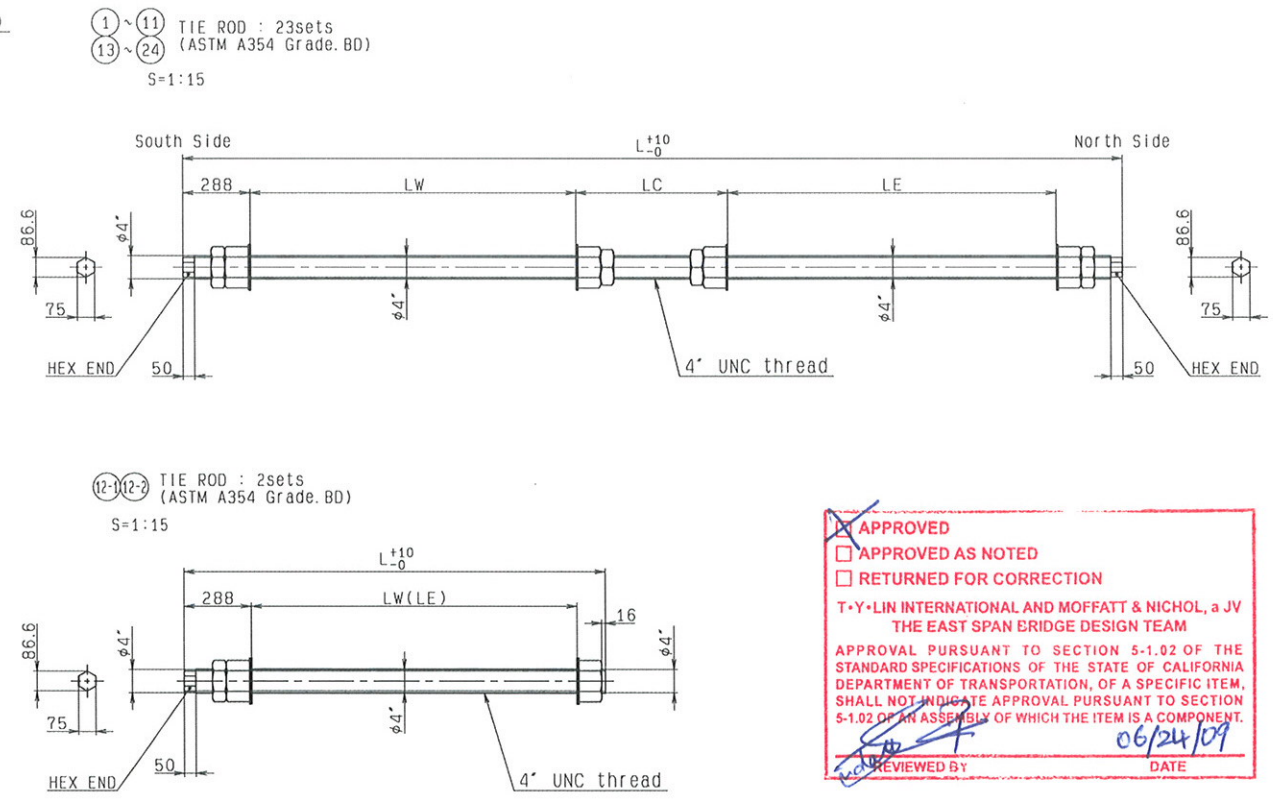
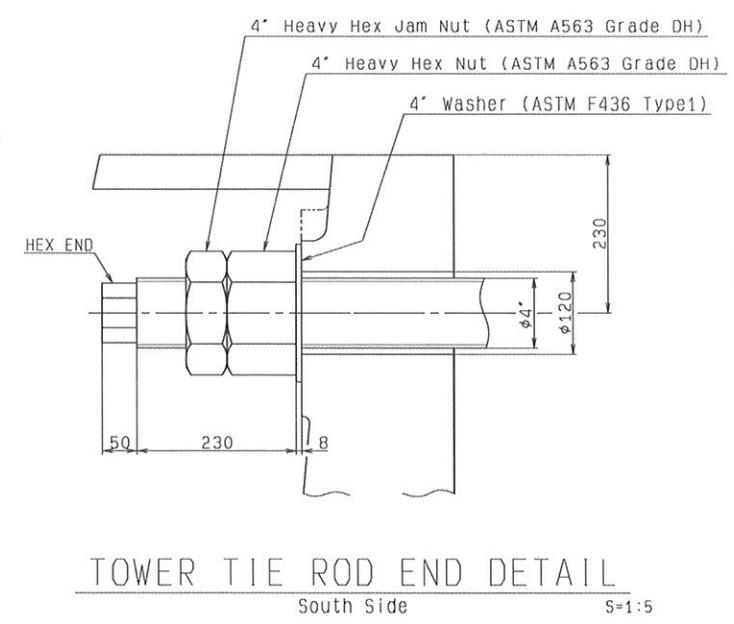
SAN FRANCISCO OAKLAND BAY BRIDGE EAST SPAN SEISMIC RETROFIT PROJECT SELF-ANCHORED SUSPENSION BRIDGE			
UNIVERSITY OF CALIFORNIA DEPARTMENT OF TRANSPORTATION			
CONTRACTOR: AMERICAN BRIDGE/FLOOR ENTERPRISES INC., A JOINT VENTURE			
CONTRACT NO.: 04-00104			
ROUTE NO.: 04-05-05-13 R213.9			
BRIDGE NO.: 34-000128			
WEST JACKING SADDLE PIPE SLEEVE DETAILS DRAWING		NO SCALE SCALE 1:15	APP'D: K. SATO CHK'D: M. YAMAMOTO DRAWN: H. TERADA
P.O. NO.: 100110-SA-00515W DWG. NO.: 100110-SA-00515W-001		REV: 0	DATE: 13 APR 2009
JST: 008 NO. 100110-0002		THE JAPAN STEEL WORKS, LTD. MURORAN PLANT STEEL PRODUCTS DEP. STORR P&T	



REVISION				
REV	DATE	DESCRIPTION	PREP'D	CHK'D
1	9 May 2009	First Issue	K. TERADA	K. SATO



No.	L	LW	LC	LE
1	5385	1499.1	1803.2	1505.8
2	5243	1499.0	1660.7	1507.0
3	5092	1490.3	1525.8	1499.7
4	4814	1471.4	1285.5	1480.2
5	4691	1463.3	1179.6	1471.7
6	4580	1455.9	1082.9	1464.2
7	4388	1443.4	917.3	1450.9
8	4308	1437.9	848.2	1445.3
9	4238	1433.0	788.2	1440.2
10	4127	1424.7	694.7	1431.6
11	4087	1421.5	661.1	1428.1
12-1	1833	1418.9	-	-
12-2	1839	-	-	1425.3
13	4026	1416.3	610.9	1422.3
14	4025	1416.2	610.5	1422.2
15	4035	1417.2	618.1	1423.1
16	4084	1421.8	658.4	1427.5
17	4124	1425.3	691.1	1430.9
18	4173	1429.2	732.6	1435.0
19	4302	1438.9	842.3	1444.8
20	4382	1444.7	910.5	1450.6
21	4472	1451.0	987.8	1457.1
22	4684	1465.6	1170.3	1472.0
23	4803	1473.3	1275.4	1478.1
24	4917	1473.5	1389.4	1477.5



- NOTES:
- All dimensions are in millimeters unless otherwise shown.
  - Bolt nut and washer shall be hot dip galvanizing.
  - The thread dimension of bolts and nuts shall be according to applicable ANSI/ASME B1.1.
  - The tolerance of the bolt dimension shall be according to applicable ANSI/ASME B18.2.1.
  - The tolerance of the nuts and jam nuts dimension shall be according to applicable ANSI/ASME B18.2.2.
  - The tolerance of the thread dimension after galvanizing shall be conformed to the requirements in applicable ASTM A354, Para. 7.3.3.
  - The tolerance of the shank straightness shall be within 0.25% of shank length or within 2.5mm per 1m.
  - Tie Rods size and Nuts, Washers material are approved by ABF-RF1-278 RO, R1, -280 RO.
  - Hex End detail is approved by ABF-RF1-1583 RO, R1.
  - The thread shall be made by Roll Threading method. This is approved by ABF-RF1-1734 RO.

APPROVED  
 APPROVED AS NOTED  
 RETURNED FOR CORRECTION

T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
 THE EAST SPAN BRIDGE DESIGN TEAM

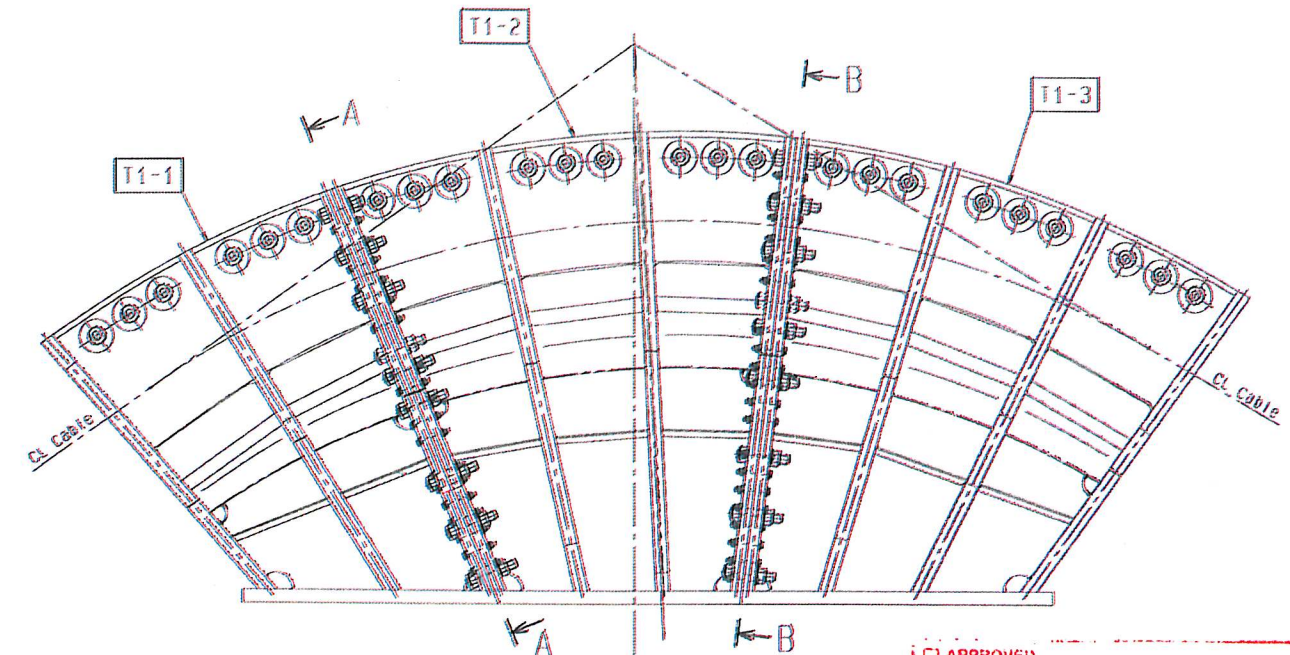
APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
 STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
 DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
 SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
 5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.

REVIEWED BY  
 DATE 06/24/09

SAN FRANCISCO OAKLAND BAY BRIDGE EAST SPAN SEISMIC RETROFIT PROJECT SELF-ANCHORED SUSPENSION BRIDGE		
OWNER: STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		
CONTRACTOR: AMERICAN BRIDGE/FLOOR ENTERPRISES, INC., A JOINT VENTURE		
CONTRACT NO.: 04-0320P4		
ROUTE NO.: 101-SR-99-1.3 R213.9		
BRIDGE NO.: 34-000R/28		
<p style="text-align: center;">TOWER SADDLE TIE ROD DETAILS DRAWING (FOR T1-1, T1-2 &amp; T1-3)</p>		SHEET NO. 003 SCALE: 1:30 APP'D: K. SATO CHK'D: M. YAMAMOTO DRAWN: H. TERADA
P.O. NO. 1160110-SA-001PSW DWG. NO. 1160110-SA-001PSW		REV. DATE
JST. JOB NO. 1160110-2407		1160110-2407 9 MAY 2009
THE JAPAN STEEL WORKS, LTD. MURORAN PLANT STEEL PRODUCTS REP. SE088 P.1		

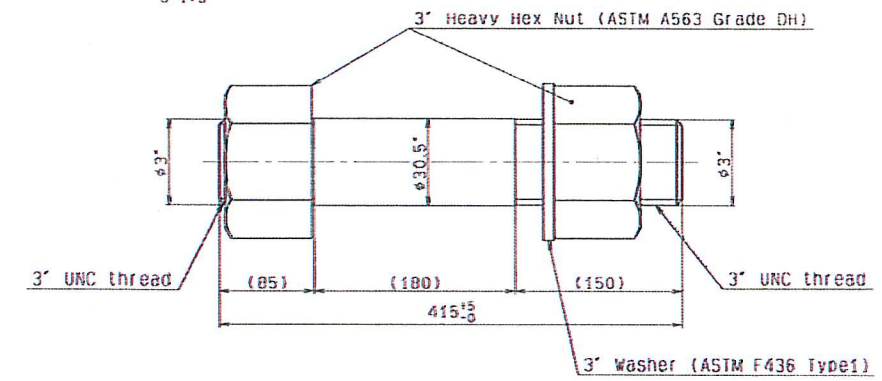


REVISIONS				
NO.	DATE	DESCRIPTION	PREP'D	CHK'D
1	1/15	FIRST ISSUE	Y. Y. LIN	Y. Y. LIN

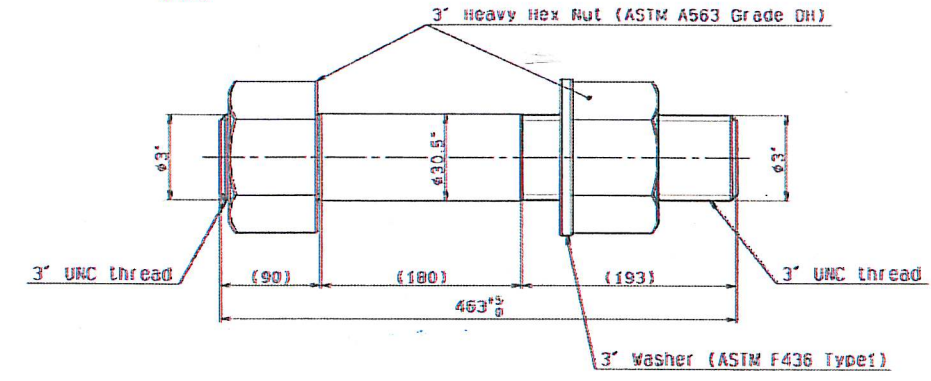


☐ APPROVED  
☒ APPROVED AS NOTED  
☐ RETURNED FOR CORRECTION  
 T-Y-LIN INTERNATIONAL AND MOFFATT & NICHOL, a JV  
 THE EAST SPAN BRIDGE DESIGN TEAM  
 APPROVAL PURSUANT TO SECTION 5-1.02 OF THE  
 STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA  
 DEPARTMENT OF TRANSPORTATION, OF A SPECIFIC ITEM,  
 SHALL NOT INDICATE APPROVAL PURSUANT TO SECTION  
 5-1.02 OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.  
 REVIEWED BY: [Signature] DATE: 06/24/09

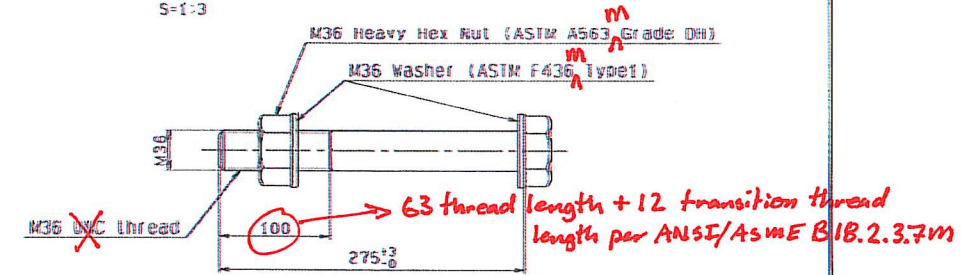
① TURNED ROD : 8sets (ASTM A354 Grade BD)  
 S=1:3



② TURNED ROD : 100sets (ASTM A354 Grade BD)  
 S=1:3



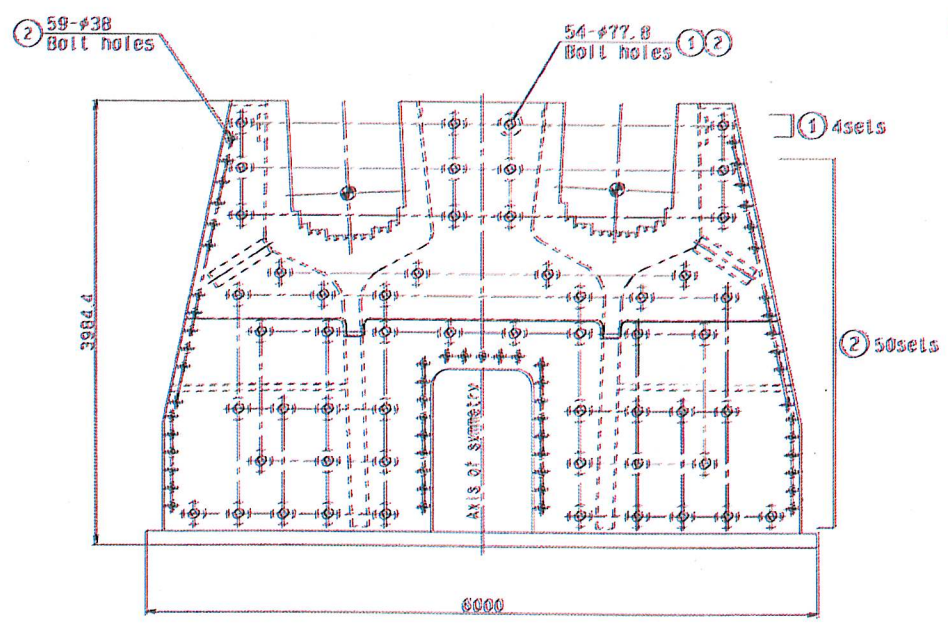
③ BOLT, NUT : 122sets (ASTM A490M)  
 S=1:3



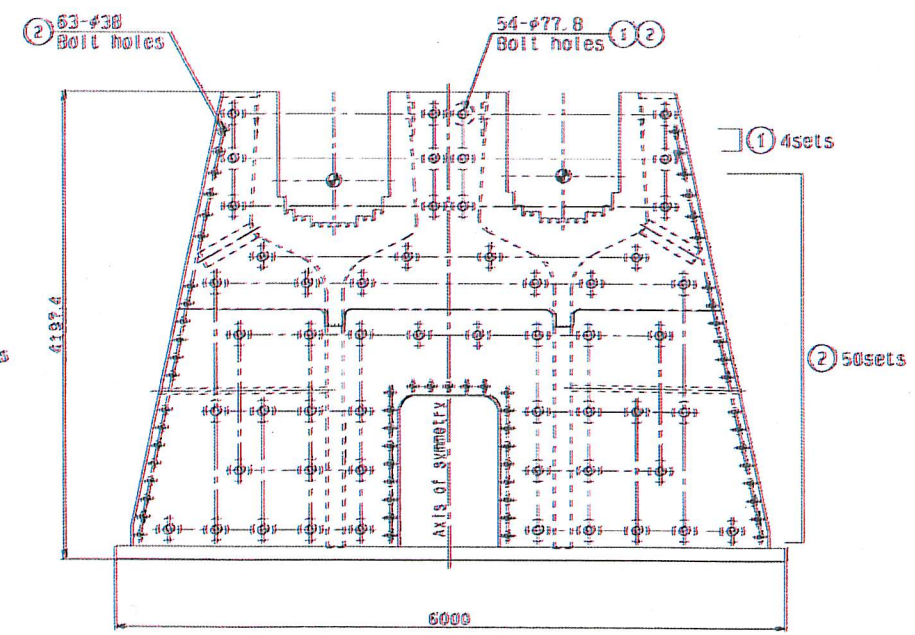
- NOTES:
- All dimensions are in millimeters unless otherwise shown.
  - Bolt nut and washer of ASTM A354 Grade BD shall be hot dip galvanizing.
  - Bolt nut and washer of ASTM A490M shall be Dacromet 320P coating.
  - The thread dimension of bolts and nuts shall be according to applicable ANSI/ASME B1.1. (ANSI/ASME B1.13m for A490m)
  - The tolerance of the bolt dimension shall be according to applicable ANSI/ASME B18.2.1. (ANSI/ASME B18.2.3.7m for A490m)
  - The tolerance of the nuts and jam nuts dimension shall be according to applicable ANSI/ASME B18.2.2. (ANSI/ASME B18.2.4.6m for A490m)
  - The tolerance of the thread dimension after galvanizing shall be conformed to the requirements in applicable ASTM A354, Para. 7.3.3.
  - The tolerance of the shank straightness shall be within 0.25% of shank length or within 2.5mm per 1m.
  - Detail and location of Turned Rod is approved by ACF-REF 1-1243 RD, R1, R2.

STRAIGHTNESS

TOWER SADDLE	
TURNED ROD	
DETAILS DRAWING	
(FOR T1-1, T1-2 & T1-3)	
DATE: 06/24/09	BY: Y. Y. LIN
DATE: 06/24/09	BY: Y. Y. LIN
THE JAPAN STEEL WORKS, LTD. (MURAHARA PLANT)	



SECTION A-A



SECTION B-B



# REQUEST FOR INFORMATION (RFI)

RFI No.: ABF-RFI-001741R01 Submitted By: Smith, Kevin Pages: 2  
RFI Date: 22-May-2009 Contact Name: Gatsos, Levi Pages Attached: 0  
Phone No. 510-808-4600

<b>Subject:</b> CCO 91 Clarification	
<b>References:</b>	
<b>Sub/Sup:</b> ABF	<b>Sub RFI #:</b>
<b>Response Required by:</b> 29-May-2009	
<b>Response affects critical path activity?</b>	

**Description:**

Per the department's response to ABF-RFI-001741R00, ABF understands the following:

- A. Complete List of Rods to be covered under CCO 91
1. East Saddle tie rod
  2. Pier E2 Shear Key - anchor rods connecting stub to the E2 concrete cross beam, with the exception of the E2 Shear Key rods located over the Pier E2 Columns which were procured prior to the issuing of CCO 91.
  3. Pier E2 Shear Key - anchor bolts connecting OBG with shear key housing
  4. Spherical Bushing Bearings (Pier E2) - anchor rods connecting hold down to E2 concrete cross beam
  5. Spherical Bushing Bearings (Pier E2) - anchor bolts to OBG
  6. Spherical Bushing Bearings (Pier E2) -Spherical bushing assembly bolts
  7. Cable bracket anchor rods
  8. Main Cable anchor rods
  9. Tower Saddle Tie Rods

Please confirm that the above list contains all rods that require additional MT testing per CCO 91.

B.  
The Tower Saddle Turned Rods have a required final tension of  $0.45 \cdot F_u$ , however to achieve this final tension the Tower Saddle Turned Rods will be temporarily tensioned in excess of  $0.5 \cdot F_u$ . ABF understands the intent of CCO 91 is to test ASTM A354 Grade BD Rods having a required final tension in excess of  $0.5 \cdot F_u$ , therefore ABF has excluded the Tower Saddle Turned Rods from the above list. Please confirm that the Tower Saddle Turned Rods do not require additional MT testing.

**Contractor Disposition:**

This RFI is being submitted for:

The Cost and Time Impact from this RFI is: Not selected

**Response:****Agreed Ext. Due Date:****Pages:** 2**Pages Attached:** 0

A: The list appears to be complete. We are not aware of any other A 354 Gr. BD fasteners requiring MT per CCO No. 91.

B: Confirmed, Tower Saddle turned Rods do not require MT testing.

**Administrative Action:**

This response resolves the RFI.

## REQUEST FOR INFORMATION (RFI)

<b>Date:</b> 04-June-2009	<b>Respondent:</b> Collins, Warren	<b>Phone No.:</b> 510-622-5661
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Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

CODE NTA2 THRU CODE NTA6

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

SPEC: Grain Size (Info Only) SIZE FINE

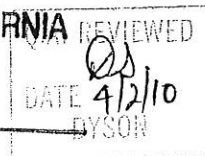
Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-075-10

NAME: SB 5-19-10



When shipping document is attached it becomes part of this certification.

I certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_ by Susan Bender  
NOTARY PUBLIC Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

CODE NTA2 THRU CODE  
NTA6

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

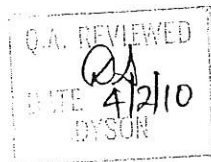
Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

STRAND CAST PROCESS

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-075-10

NAME: SB 5-19-10



**DEPARTMENT OF TRANSPORTATION**

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

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002138**Date Inspected:** 06-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender system**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC104.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

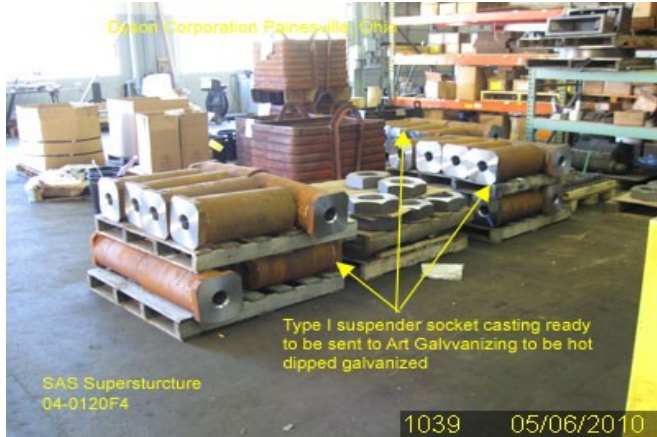
The following digital photograph below illustrates observation of the activities being performed.

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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### Summary of Conversations:

As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

---

<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager, Craig	QA Reviewer

---



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

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002139**Date Inspected:** 07-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar/Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC091.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

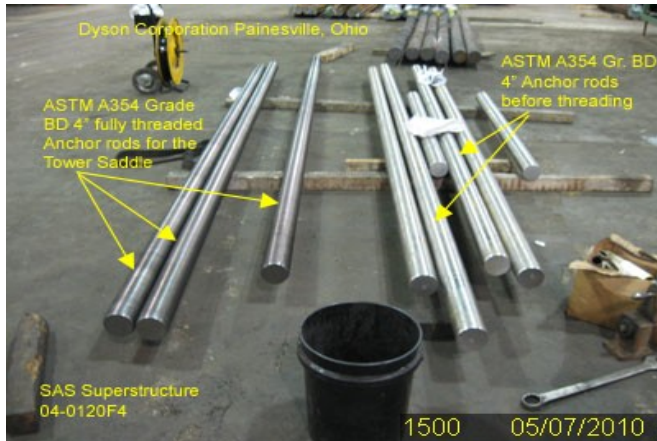
The following digital photograph below illustrates observation of the activities being performed.

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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### Summary of Conversations:

As stated with this report.

### Comments

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<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager, Craig	QA Reviewer

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

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 99.15**SOURCE INSPECTION REPORT****Resident Engineer:** Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002151**Date Inspected:** 10-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs/Art Galvanizing**Location:** Painesville/Cleveland, OH**Quality Control Contact:** Bob Bobnar, Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

QA Inspector Brannon met with Dyson Quality Control (QC) Mr. Russell Walsh and Art Galvanizing Manager Adrienne Klein, at Art Galvanizing in Cleveland, Ohio. QA Inspector Brannon observed ASTM A563 Grade DH 4.00"-4UNC-2B heavy hex nuts, ASTM A563 Grade DH 4.00"-4UNC-2B heavy hex jam nuts, and ASTM F436 Type I 4.00" diameter hardened flat washers for bid items #59 components at different stages of the galvanizing process. Items observed by QA Inspector Brannon appear to comply to contract documents.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC091.

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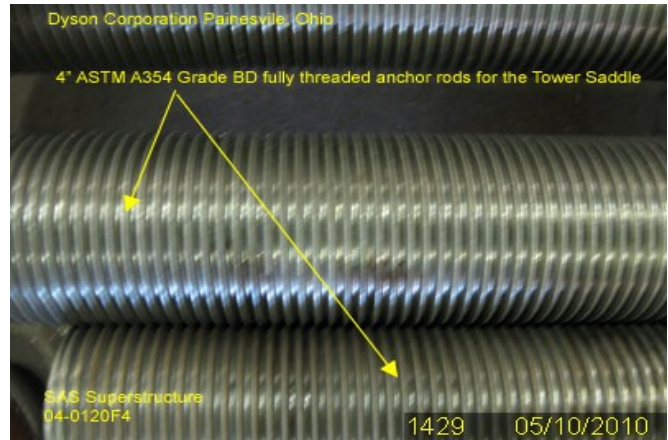
## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### Comments

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<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager, Craig	QA Reviewer

---



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

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002171**Date Inspected:** 12-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar, Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

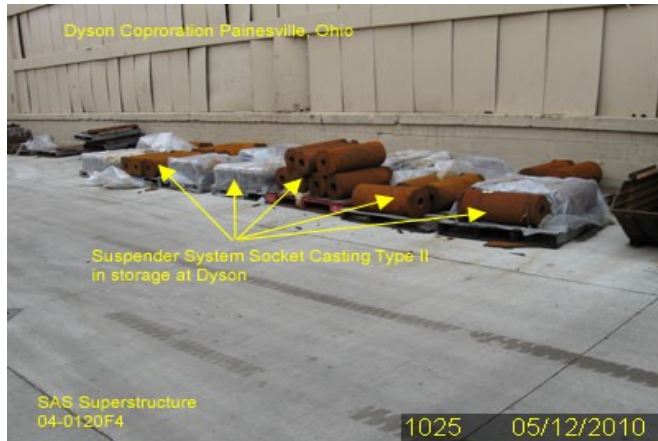
The following digital photograph below illustrates observation of the activities being performed.

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# SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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## Summary of Conversations:

As stated within this report.

## Comments

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---

**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

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**Reviewed By:** Hager, Craig

QA Reviewer



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Office of Structural Materials

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

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002172**Date Inspected:** 13-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar, Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.

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# SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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## Summary of Conversations:

As stated within this report.

## 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

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**Reviewed By:** Hager, Craig

QA Reviewer



**DEPARTMENT OF TRANSPORTATION**

DIVISION OF ENGINEERING SERVICES

Office of Structural Materials

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Bay Area Branch  
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Vallejo, CA 94592-1133  
(707) 649-5453  
(707) 649-5493

Contract #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002173**Date Inspected:** 14-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar, Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** n/a**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

QA Inspector Brannon was informed by QCM Mr. Bob Bobnar and QC Mr. Russell Walsh that Stork Herron Testing will be on site Monday, May 17, 2010 to start Magnetic Particle Testing on the 4.00"4UNC-2A, ASTM A354 Grade BD fully threaded Tower Saddle Tie Rods bid item #59. Reference documents State Letter 05.03.01-002906, ABF-RFI-00174R01, CCO 91.

QA Inspector Brannon informed Mr. Bobnar that check samples for the ASTM A354 Grade BD, 3.00"-4UNC-2A Tower Saddle Turn Rods, HDG, lot code's NNF2, NNF3, & NNF4, heat #7567767 results are satisfactory for use. QA Inspector Brannon relayed this information to the Structural Materials Representatives (SMR) Mr. Kittrich Guest. Reference documents: Caltrans QA Lot No: B208-059-10; Sample Identification Card TL-101 No: C726466; and Structural Materials Testing Laboratory Sample No: SM-10-0423.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

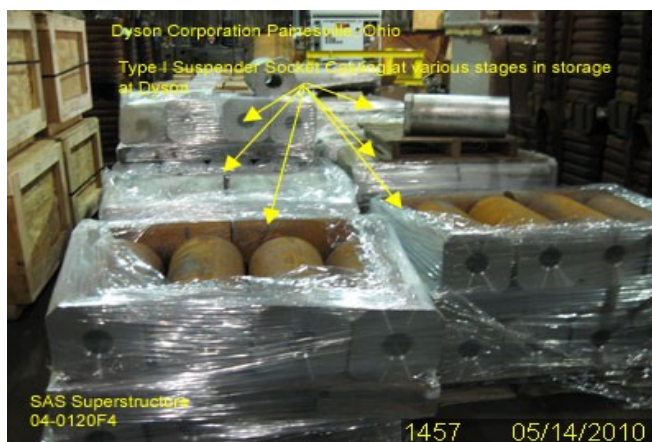
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03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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<b>Inspected By:</b>	Brannon, Sherri
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Quality Assurance Inspector
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<b>Reviewed By:</b>	Hager, Craig
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QA Reviewer
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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002193**Date Inspected:** 17-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 1300**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 2130**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio

<b>Quality Control Contact:</b>	Bob Bobnar, Russell Walsh, George			<b>Quality Control Present:</b>	<b>Yes</b>	<b>No</b>	
<b>Material transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Sampled Items:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Stock Transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>OK to Cut:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Rebar Test Witness:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Delayed/Cancelled:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Other:</b>	Fastener Assemblies						
<b>Bridge No:</b>	34-0006			<b>Component:</b>	Tower Saddle, Suspender System		
<b>Bid Item:</b>	59, 68			<b>Lot No:</b>	B208-072-10, B208-073-10		

**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

Mr. Bob Bobnar informed QA Inspector Brannon that ASTM A354 Grade BD 3.00"-4UNC-2A x 415mm tower saddle turn rods, HDG with 85mm and 150mm of usable thread, ASTM A563 Grade DH 3.00"-4UNC-2B heavy hex nuts, HDG, and ASTM F436 Type 1, 3.00" diameter hardened flat washers HDG for bid item #59 are ready for QA Inspection and orange tag release for shipping to American Bridge/Fluor Enterprises, in Oakland, CA. QA Inspector Brannon reviewed applicable documents and verified quantities. After review of the documents and material to be shipped QA Inspector Brannon assigned Caltrans lot number's B208-072-10. See Caltrans Report Of Inspection Of Material, TL-29 dated May 17, 2010 for specific information.

Mr. Bob Bobnar informed QA Inspector Brannon that ASTM A354 Grade BD 3.00"-4UNC-2A x 463mm tower saddle turn rods, HDG with 90mm and 193mm of usable thread, ASTM A563 Grade DH 3.00"-4UNC-2B heavy hex nuts, HDG, and ASTM F436 Type 1, 3.00" diameter hardened flat washers, HDG for bid item #59 are ready for QA Inspection and orange tag release for shipping to American Bridge/Fluor Enterprises, in Oakland, CA. QA Inspector Brannon reviewed applicable documents and verified quantities. After review of the documents and material to be shipped QA Inspector Brannon assigned Caltrans lot number's B208-073-10. See Caltrans Report Of Inspection Of Material, TL-29 dated May 17, 2010 for specific information.

QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners

## SOURCE INSPECTION REPORT

( Continued Page 2 of 3 )

assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon met with Dyson Quality Control (QC) Mr. Russell Walsh and Stork Herron Testing (SHT) Non-Destructive Testing (NDT) Technician Mr. Matt Novak Level III. QA inspector Brannon was informed that Wet-Fluorescent Magnetic Particle Testing (Wet Mag) will be conducted on 4" diameter ASTM A354 Grade BD Tower Saddle Tie Rods that have been threaded at Dyson Corporation. Reference documents State Letter 05.03.01-002906, ABF-RFI-00174R01, CCO 91.

QA Inspector Brannon noted that the tower saddle tie rods have fully machined threads with hex ends. QA Inspector Brannon randomly observed Mr. Novak performing Wet Mag on the machined threads of the tie rods. QA Inspector noted that 1st shift Quality Control (QC) Mr. Russell Walsh and 2nd shift QC Mr. George Oros was present during Wet Mag inspection. Upon completion of the inspection, QA Inspector Brannon was informed by Mr. Novak that no relevant indications were observed. QA Inspector Brannon also performed Wet Mag verification. See Caltrans Magnetic Particle Testing Report, TL-6028 dated May 17, 2010 for specific information.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:



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## SOURCE INSPECTION REPORT

( Continued Page 3 of 3 )

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As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
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<b>Reviewed By:</b>	Hager, Craig	QA Reviewer
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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002194**Date Inspected:** 18-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 1300**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 2000**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio

<b>Quality Control Contact:</b>	Bob Bobnar, Russell Walsh, George			<b>Quality Control Present:</b>	<b>Yes</b>	<b>No</b>	
<b>Material transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Sampled Items:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Stock Transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>OK to Cut:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Rebar Test Witness:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Delayed/Cancelled:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Other:</b>	Fastener Assemblies						
<b>Bridge No:</b>	34-0006			<b>Component:</b>	Tower Saddle, Suspender System		
<b>Bid Item:</b>	59, 68			<b>Lot No:</b>	n/a		

**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon met with Dyson Quality Control (QC) Mr. Russell Walsh and Stork Herron Testing (SHT) Non-Destructive Testing (NDT) Technician Mr. Matt Novak Level III. QA inspector Brannon was informed that Wet-Fluorescent Magnetic Particle Testing (Wet Mag) will be conducted on 4" diameter ASTM A354 Grade BD Tower Saddle Tie Rods that have been threaded at Dyson Corporation. Reference documents State Letter 05.03.01-002906, ABF-RFI-00174R01, CCO 91.



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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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QA Inspector Brannon noted that the tower saddle tie rods have fully machined threads with hex ends. QA Inspector Brannon randomly observed Mr. Novak performing Wet Mag on the machined threads of the tie rods. QA Inspector noted that 2nd shift Quality Control Mr. George Oros was present during Wet Mag inspection. Upon completion of the inspection, QA Inspector Brannon was informed by Mr. Novak that no relevant indications were observed. QA Inspector Brannon also performed Wet Mag verification. See Caltrans Magnetic Particle Testing Report, TL-6028 dated May 18, 2010 for specific information.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager, Craig	QA Reviewer

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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002195**Date Inspected:** 19-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 1000**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1830**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio

<b>Quality Control Contact:</b>	Bob Bobnar, Russell Walsh, George			<b>Quality Control Present:</b>	<b>Yes</b>	<b>No</b>	
<b>Material transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Sampled Items:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Stock Transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>OK to Cut:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Rebar Test Witness:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Delayed/Cancelled:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Other:</b>	Fastener Assemblies						
<b>Bridge No:</b>	34-0006			<b>Component:</b>	Tower Saddle, Suspender System		
<b>Bid Item:</b>	59, 68			<b>Lot No:</b>	B208-074,075,076,077,078,079,80-10		

**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

Mr. Bob Bobnar informed QA Inspector Brannon that the ASTM A354 Grade BD 4.00"-4UNC-2A Tower Saddle Tie Rods with various lengths for bid items #59 are ready for QA Inspection and green tag release for shipping to Monnig Industries in Glasgow, Missouri for hot dip galvanizing. QA Inspector Brannon reviewed applicable documents and verified quantities. After review of the documents and material to be shipped QA Inspector Brannon assigned Caltrans lot number's for tracking purposes. See Caltrans Component Material Inspection Report, TL-6011 dated May 19, 2010 for specific information.

QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.



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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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QA Inspector Brannon met with Dyson Quality Control (QC) Mr. Russell Walsh and Stork Herron Testing (SHT) Non-Destructive Testing (NDT) Technician Mr. Matt Novak Level III. QA inspector Brannon was informed that Wet-Fluorescent Magnetic Particle Testing (Wet Mag) will be conducted on 4" diameter ASTM A354 Grade BD rods that have been threaded at Dyson Corporation. Reference documents State Letter 05.03.01-002906, ABF-RFI-00174R01, CCO 91.

QA Inspector Brannon noted that the tower saddle tie rods have fully machined threads with hex ends. QA Inspector Brannon randomly observed Mr. Novak performing Wet Mag on the machined threads of the tie rods. QA Inspector noted that 2nd shift Quality Control Mr. George Oros was present during Wet Mag inspection. Upon completion of the inspection, QA Inspector Brannon was informed by Mr. Novak that no relevant indications were observed. QA Inspector Brannon also performed Wet Mag verification. See Caltrans Magnetic Particle Testing Report, TL-6028 dated May 19, 2010 for specific information.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

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**Reviewed By:** Hager, Craig

QA Reviewer

**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.8**COMPONENT MATERIAL INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** CMI-000232**Date Inspected:** 19-May-2010**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Bridge No.:** 34-0006**OSM Arrival Time:** 1000**OSM Departure Time:** 1830**Component:#** Tower Saddle Tie Rods

The following material has been inspected in accordance with Section 6 of the Standard Specifications at the above location. At this point in the fabrication process it appears to comply with contract plans and specifications.

To be shipped to the following vendor or locations: Monnig Industries, Inc, 400 Industrial Dr. Glasgow, MO

<b>Lot #</b>	<b>Bid Item #</b>	<b>Quantity</b>		<b>Material Description</b>
B208-074-10	59	2	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 1840mm TFL Tie Rods with hex drive on one end Lot Code NTA5 heat #99882
B208-075-10	59	5	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 1840mm TFL Tie Rods, Lot Code NTA2, NTA3, NTA4, NTA5, NTA6, Heat #99882, QA Samples
B208-076-10	59	1	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 5185mm TFL Tie Rods with hex drive on each end Lot Code NTA2 heat #99882
B208-077-10	59	1	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4860mm TFL Tie Rods with hex drive on each end Lot Code NTA5 heat #99882
B208-078-10	59	2	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4755mm TFL Tie Rods with hex drive on each end Lot Code NTA2 heat #99882
B208-079-10	59	2	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4635mm TFL Tie Rods with hex drive on each end Lot Code NTA2 heat #99882
B208-080-10	59	3	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4475mm TFL Tie Rods with hex drive on each end Lot Code NTA4 heat #99882

**Identification:** Green tagged attached to COC**Summary of Items Observed:**

QA Inspector Brannon reviewed the contractor's Certificate of Compliance (C.O.C) and shipping documentation. QA Inspector Brannon also made random observations of the materials as they were presented. QA Inspector Brannon noted that the material and documentation appeared to be in general compliance with the contract requirements. QA Inspector Brannon reviewed the contractor's Certificate of Compliance (C.O.C) and shipping documentation. QA Inspector Brannon issued green tags for tacking with Caltrans QA lot number above. QA Inspector Brannon was informed by Mr. Bobnar that the above 4.00"-4UNC-2A Tower Saddle Tie Rods are being shipped to Monnig Industries to be hot dipped galvanized. Reference documents State Letter 05.03. 01-007263, RFI-SUB-002116R00.



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## COMPONENT MATERIAL INSPECTION REPORT

( Continued Page 2 of 2 )

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### Summary of Conversations:

As stated within this report.

### Comments

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<b>Inspected By:</b>	Brannon, Sherri	Quality Assurance Inspector
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<b>Reviewed By:</b>	Hager, Craig	QA Reviewer
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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:** Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002196**Date Inspected:** 20-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 930**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1800**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio

<b>Quality Control Contact:</b>	Bob Bobnar, Russell Walsh, George			<b>Quality Control Present:</b>	<b>Yes</b>	<b>No</b>	
<b>Material transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Sampled Items:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Stock Transfer:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>OK to Cut:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Rebar Test Witness:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Delayed/Cancelled:</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Other:</b>	Fastener Assemblies						
<b>Bridge No:</b>	34-0006			<b>Component:</b>	Tower Saddle, Suspender System		
<b>Bid Item:</b>	59, 68			<b>Lot No:</b>	B208-081,082,083,084-10		

**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

Mr. Bob Bobnar informed QA Inspector Brannon that the ASTM A354 Grade BD 4.00"-4UNC-2A Tower Saddle Tie Rods with various lengths for bid items #59 are ready for QA Inspection and green tag release for shipping to Monnig Industries in Glasgow, Missouri for hot dip galvanizing. QA Inspector Brannon reviewed applicable documents and verified quantities. After review of the documents and material to be shipped QA Inspector Brannon assigned Caltrans lot number's for tracking purposes. See Caltrans Component Material Inspection Report, TL-6011 dated May 20, 2010 for specific information.

QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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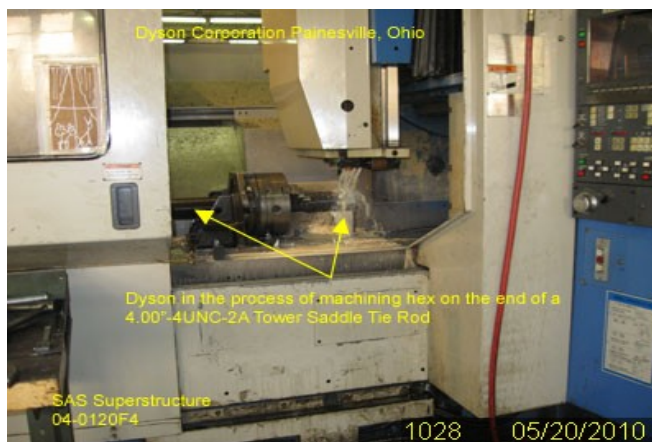
01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon met with Dyson Quality Control (QC) Mr. Russell Walsh and Stork Herron Testing (SHT) Non-Destructive Testing (NDT) Technician Mr. Matt Novak Level III. QA inspector Brannon was informed that Wet-Fluorescent Magnetic Particle Testing (Wet Mag) will be conducted on 4" diameter ASTM A354 Grade BD rods that have been threaded at Dyson Corporation. Reference documents State Letter 05.03.01-002906, ABF-RFI-00174R01, CCO 91.

QA Inspector Brannon noted that the tower saddle tie rods have fully machined threads with hex ends. QA Inspector Brannon randomly observed Mr. Novak performing Wet Mag on the machined threads of the tie rods. QA Inspector noted that 2nd shift Quality Control Mr. George Oros was present during Wet Mag inspection. Upon completion of the inspection, QA Inspector Brannon was informed by Mr. Novak that no relevant indications were observed. QA Inspector Brannon also performed Wet Mag verification. See Caltrans Magnetic Particle Testing Report, TL-6028 dated May 20, 2010 for specific information.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### 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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

**Reviewed By:** Hager, Craig

QA Reviewer

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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.8**COMPONENT MATERIAL INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** CMI-000234**Date Inspected:** 20-May-2010**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Bridge No.:** 34-0006**OSM Arrival Time:** 930**OSM Departure Time:** 1800**Component:#** Tower Saddle Tie Rods

The following material has been inspected in accordance with Section 6 of the Standard Specifications at the above location. At this point in the fabrication process it appears to comply with contract plans and specifications.

To be shipped to the following vendor or locations: Monnig Industries, Inc, 400 Industrial Dr. Glasgow, MO

<b>Lot #</b>	<b>Bid Item #</b>	<b>Quantity</b>		<b>Material Description</b>
B208-081-10	59	3	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4310mm TFL Tie Rods with hex drive on both ends, Lot Code NTA5 heat #99882
B208-082-10	59	1	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4580mm TFL Tie Rods with hex drive on both ends Lot Code NTA4 heat #99882
B208-083-10	59	1	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 5035mm TFL Tie Rods with hex drive on both ends, Lot Code NTA4 heat #99882
B208-084-10	59	3	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4175mm TFL Tie Rods with hex drive on both ends, Lot Code NTA6 heat #99882

**Identification:** Green tagged attached to COC**Summary of Items Observed:**

QA Inspector Brannon reviewed the contractor's Certificate of Compliance (C.O.C) and shipping documentation. QA Inspector Brannon also made random observations of the materials as they were presented. QA Inspector Brannon noted that the material and documentation appeared to be in general compliance with the contract requirements. QA Inspector Brannon issued green tags for tacking with Caltrans QA lot number from above. QA Inspector Brannon was informed by Mr. Bobnar that the above 4.00"-4UNC-2A Tower Saddle Tie Rods are being shipped to Monnig Industries to be hot dipped galvanized. Reference documents State Letter 05.03. 01-007263, RFI-SUB-002116R00.

**Summary of Conversations:**

As stated within this report.

**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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

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## COMPONENT MATERIAL INSPECTION REPORT

( Continued Page 2 of 2 )

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**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

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**Reviewed By:** Hager, Craig

QA Reviewer

**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:** Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002197**Date Inspected:** 21-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Quality Control Contact:** Bob Bobnar, Russell Walsh**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** Fastener Assemblies**Bridge No:** 34-0006**Component:** Tower Saddle, Suspender System**Bid Item:** 59, 68**Lot No:** B208-085-10, B208-086-10**Summary of Items Observed:**

The Caltrans Quality Assurance (QA) Inspector Sherri Brannon was present at Dyson Corporation in Painesville, Ohio, to observe the fabrication of components that will be used in the San Francisco / Oakland Bay Bridge (SFOBB) project.

Mr. Bob Bobnar informed QA Inspector Brannon that the ASTM A354 Grade BD 4.00"-4UNC-2A Tower Saddle Tie Rods with various lengths for bid items #59 are ready for QA Inspection and green tag release for shipping to Monnig Industries in Glasgow, Missouri for hot dip galvanizing. QA Inspector Brannon reviewed applicable documents and verified quantities. After review of the documents and material to be shipped QA Inspector Brannon assigned Caltrans lot number's for tracking purposes. See Caltrans Component Material Inspection Report, TL-6011 dated May 21, 2010 for specific information.

The QA Inspector Brannon randomly observed Dyson personnel machining / fabricating components for fasteners assemblies for the following: bid item 59 - Furnish Structural Steel (Bridge) (Saddle), and bid item 68 Furnish Suspender System. QA Inspector Brannon made general observations of the cutting, heat treatment, milling, machining and threading of the various components (rods, bolts, nuts, washers). The QA Inspector Brannon noted that all observed work appeared to be performed to commonly accepted industry standards and procedures. Also see Reference Documents CCO 91, CC0 104, ABF-RFI-001741R01, State Letter 05.03.01-02360, State Letter 05.03.01-002906, State Letter 05.03.01-007296.

QA Inspector Brannon observed no work being performed at Dyson's horizontal milling machine for the modifications to the suspender socket castings due to other work. Reference Document State Letter 05.03.



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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

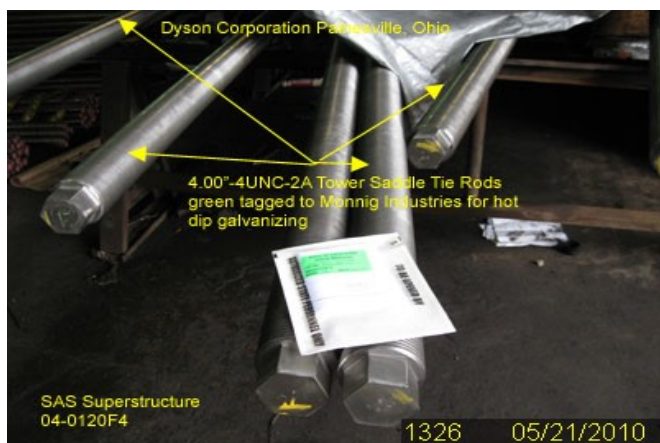
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01-007296 and CC0 104. Type I suspender casting to date that have been milled on 2 sides total, 3 each.

QA Inspector Brannon was informed by QCM Mr. Bob Bobnar that Dyson recieved 142 each Type I Suspender Socket Casting for WireCo todysy. Mr. Bobnar also, stated that Dyson would be starting to machine the horizontal sides on the Type I casting mid next week or the first week in June. QA Inspector Brannon informed SMR Mr. Kittic Guest of the above.

QA Inspector Brannon also updated tracking log for tracking different components at various stages for machining, galvanizing, painting, magnetic particle testing, shipping and sampling of QA check samples.

The following digital photograph below illustrates observation of the activities being performed.



### Summary of Conversations:

As stated within this report.

### Comments

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<b>Inspected By:</b>	Brannon, Sherri
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Quality Assurance Inspector
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<b>Reviewed By:</b>	Hager, Craig
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QA Reviewer
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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.8**COMPONENT MATERIAL INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** CMI-000235**Date Inspected:** 21-May-2010**Contractor:** Dyson Corp. & Subs**Location:** Painesville, Ohio**Bridge No.:** 34-0006**OSM Arrival Time:** 800**OSM Departure Time:** 1630**Component:#** Tower Saddle Tie Rods

The following material has been inspected in accordance with Section 6 of the Standard Specifications at the above location. At this point in the fabrication process it appears to comply with contract plans and specifications.

To be shipped to the following vendor or locations: Monnig Industries, Inc, 400 Industrial Dr. Glasgow, MO

Lot #	Bid Item #	Quantity		Material Description
B208-085-10	59	5	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 4090mm TFL Tie Rods with hex drive on both ends, Lot Code NTA3 heat #99882
B208-086-10	59	2	ea	ASTM A354 Gr. BD 4.00"-4UNC-2A x 5325mm TFL Tie Rods with hex drive on both ends, Lot Code NTA6 heat #99882

**Identification:** Green tagged attached to COC**Summary of Items Observed:**

QA Inspector Brannon reviewed the contractor's Certificate of Compliance (C.O.C) and shipping documentation. QA Inspector Brannon also made random observations of the materials as they were presented. QA Inspector Brannon noted that the material and documentation appeared to be in general compliance with the contract requirements. QA Inspector Brannon issued green tags for tacking with Caltrans QA lot number from above. QA Inspector Brannon was informed by Mr. Bobnar that the above 4.00"-4UNC-2A Tower Saddle Tie Rods are being shipped to Monnig Industries to be hot dipped galvanized. Reference documents State Letter 05.03. 01-007263, RFI-SUB-002116R00.

**Summary of Conversations:**

As stated within this report.

**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 Nina Choy, (510) 385-5910, who represents the Office of Structural Materials for your project.

**Inspected By:** Brannon, Sherri

Quality Assurance Inspector

**Reviewed By:** Hager, Craig

QA Reviewer

**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002226**Date Inspected:** 24-May-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Glasgow, MO.

**Quality Control Contact:** Ryan Monnig  
**Material transfer:** Yes No N/A  
**Stock Transfer:** Yes No N/A  
**Rebar Test Witness:** Yes No N/A

**Quality Control Present:** Yes No  
**Sampled Items:** Yes No N/A  
**OK to Cut:** Yes No N/A  
**Delayed/Cancelled:** Yes No N/A

**Other:** As stated below**Bridge No:** 34-0006**Component:** TFL Tower Saddle Tie Rods**Bid Item:** 59**Lot No:** B304-014-10**Summary of Items Observed:**

On this date Quality Assurance (QA) Inspector Terry Hipes was present as requested at Monnig Industries in Glasgow, MO. to observe the galvanizing of tower saddle hardware that will be used on the San Francisco/Oakland Bay Bridge (SFOBB) project.

At Monnig Industries this QA Inspector met with Mr. Ryan Monnig and was informed that (5) QA testing samples manufactured by Dyson Corporation, drawing number JSW-TS-017, 4"-4 x 72.44" long, TFL Tower Saddle Tie Rods, (Heat# 99882) with the following Lot Codes, NTA2, NTA3, NTA4, NTA5 and NTA6 are to be grit blasted and galvanized. Mr. Ryan Monnig stated that the grit blasting by Phoenix Manufacturing is complete and the (5) samples are in the process of being galvanized. This QA Inspector observed Monnig personnel removing the (5) samples from the galvanizing bath and spinning the samples at a high RPM to remove the excess galvanizing from the threads. This QA Inspector observed Monnig personnel wire brushing the threads to smooth out any roughness and remove any excessive galvanize build up. This QA Inspector observed Monnig personnel screwing a nut on the galvanized threads to ensure the mating parts engage properly. This QA Inspector did a random observation of the finished materials as they were presented. This QA reviewed the contractors Certificate of Conformance (CoC) and the green tag documentation received with the material. This QA Inspector noted that the materials and documentation appears to be in compliance with the contract requirements. This QA Inspector issued a TL-101 with Caltrans QA Lot No. B304-014-10 for the (5) samples listed above. The (5) samples are to be shipped to the Caltrans testing lab at, 5900 Folsom Blvd. Sacramento, CA.

Please see photos below.

**Summary of Conversations:**



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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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As noted above



### Comments

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<b>Inspected By:</b>	Hipes,Terry	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager,Craig	QA Reviewer

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State of California

Department of Transportation

**Structural Materials Testing Laboratory****5900 Folsom Boulevard, Sacramento, CA 95819****TEST REPORT**

CERTIFICATE NO. 2364.01

Remarks

ref: ASTM A354 Grade BD, A153, TM03. Bolt Heat #99882, Lot Codes NTA2, NTA3, NTA4 NTA5, NTA6.

Sample No: SM-10-0537

Date Sampled: 05/24/10

Date Rec'd: 05/27/10

Date Reported: 06/03/10

Lot No: B30401410

TL-101 / SIC No: C710103

Contract/Permit No: 04-0120F4

Material: A354 Grade BD HDG Tower Saddle Tie Rods 4"-4 x 72.44"

Manufacturer: Monnig Industires

Sampler: Terry Hipes

Results: SAMPLES SUBMITTED ARE SATISFACTORY FOR USE

SOURCE	DISTRICT	E.A.	SUB JOB	SPECIAL DESIGNATION	OBJECT
59318	04	0120F3			1270

5-27 SM-10-0537  
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
SAMPLE IDENTIFICATION CARD  
TL-0101 (REV. 10/97) CARD NUMBER C710103

**PRELIMINARY TESTS**  
☐ PROCESS TESTS  
☐ ACCEPTANCE TESTS  
**INDEPENDENT ASSURANCE TESTS**  
☐ DIST. LAB  
☒ TRANS. LAB  
☐ SPECIAL TESTS

**SAMPLE SENT TO:**  
☐ HDQTRS. LAB  
☐ BRANCH LAB  
☐ DIST. LAB  
 SHIPMENT NO.  
 AUTHORIZATION NO.

FIELD NO.  
DIST. LAB NO. 672  
LOT NO. B304-014-10  
P.O. OR REQ. NO.

SAMPLE OF 5 ea. 4"-4 x 72.44" Lg. TFL tower Saddle  
 FOR USE IN tie rods. HT-99882 Lot Codes: NTA2,  
NTA3, NTA4, NTA5, and NTA6  
 SAMPLE FROM ASTM A-354 Gr. BD

DEPTH  
LOCATION OF SOURCE Monnig Ind.  
400 Industrial Dr. Glasgow, MO.  
 THIS SAMPLE IS SHIPPED IN AND IS ONE OF  
 (NO. CONTAINERS) 5 SAMPLES REPRESENTING (TENS, GALS, BBLs, STA, ETC.)  
 OWNER OR MANUFACTURER  
 TOTAL QUANTITY AVAILABLE  
 TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY  
 DATE NEEDED  
 REMARKS Manufactured by Dyson  
Galvanizing by Monnig Ind.

COVER ADDITIONAL INFORMATION WITH LETTER  
 DATE SAMPLED 5/24/10  
 BY Terry Hipes TITLE QA Inspector  
 DIST. CO. RTE. PM  
 LIMITS 04-0120F4 Specials/ASTM A354  
10-1.59, 10-1.60 & 10-1.61 Gr. BD  
 CONT. NO. 04-1020F4  
 FED. NO.  
 RES. ENGR. OR SUPT. Gary Pursell  
 ADDRESS 333 Burma Rd. Oakland, CA.  
 CONTRACTOR American Bridge/Flyer JV  
375 Burma Rd. Oakland, CA.

ENCLOSE WITH SAMPLE

Print

# 505 SAMPLES



Department of Transportation  
Structural Materials Testing Laboratory  
UTM: BALDWIN 60 Kip

SM Number = 10-0537

Sample	Heat Number	Diameter (in)	Area (in <sup>2</sup> )	Stress at Offset (psi)	Tensile Strength (psi)	Elongation in 4 x d (%)	Tested By
A	NTA2	0.502	0.1979	123428	158940	14.2	EMcCrory
B	NTA2	0.501	0.1971	126486	163140	16	EMcCrory
A	NTA3	0.502	0.1979	142157	167470	13.8	EMcCrory
B	NTA3	0.502	0.1979	160531	165580	14.8	EMcCrory
A	NTA4	0.504	0.1995	138238	163870	15.6	EMcCrory
B	NTA4	0.503	0.1987	134889	161160	15.3	EMcCrory
A	NTA5	0.502	0.1979	137925	163630	15	EMcCrory
B	NTA5	0.502	0.1979	127909	163830	14.9	EMcCrory
A	NTA6	0.501	0.1971	133212	172480	15.2	EMcCrory
B	NTA6	0.501	0.1971	126088	159980	14.2	EMcCrory



STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**TRANSPORTATION LABORATORY**  
**REPORT OF TESTS**  
 TL - 619 (REV. 5/95)

S. M. NO.	10-0537	DATE RECEIVED	6/2/10
T 101 NO.	C-710103	CONT. W.O. OR P.O. NO.	04-0120F4
LOT NO.	330401410	F.A.P. NO.	

TEST NAME	DISTRICT	COUNTY	ROUTE	POST MILES
CONTRACTOR	SAMPLED BY		DATE SAMPLED	SUPPLY SOURCE
AGENCY	MANUFACTURER		MATERIAL TESTED FOR	

SAMPLE NO.	TYPE	HEAT NO.	SIZE	AREA		YIELD MPa		PSI	ACTUAL	ULTIMATE MPa	ELONG. IN.-%	RED. AREA %	COLD BEND	CHEMICAL ANALYSIS					A OR E
				BEFORE	AFTER	ACTUAL	PSI							C	MN	P	S	SI	
A		NTA2	502	2026	2.313			123428		158940	14.2								
B		"	501	2026	2.350			126486		163140	16.0								
A		NTA3	502	2026	2.306			142157		167470	13.8								
B		"	502	2025	2.324			165531		165580	14.8								
A		NTA4	504	2027	2.343			138238		163870	15.6								
B		"	503	2026	2.335			134889		161160	15.3								
A		NTA5	502	2027	2.332			137925		163630	15.0								
B		"	502	2027	2.329			127909		163830	14.9								
A		NTA6	501	2027	2.336			133212		172480	15.2								
B		"	501	2026	2.314			126088		159780	14.2								

SPECIFICATIONS

A354 DD

REMARKS

DATE TESTED	6/3/10	TESTED BY	Erin	APPROVED BY	
FM 3018 M 85					

SM Number 10-0537

Lot Number B30401410

Page 1 of 1

Contract 04-0120F4

TL-0101 Number C710103

Date Rec'd. 6/2/10

Date Tested: 6/2/10

Bolts: A 354 BD

Lab Technician: Erin

Sample No.	1A	1B	1C	1D	1E				
Heat # No.	99882	-	-	-	-				
Size	4"-4	-	-	-	-				
Product Markings	N/A	-	-	-	-				
Pitch Diameter	38.51	38.505	38.51	38.52	38.49	✓			
Ring Gages Go/Nogo	N/A	-	-	-	-				
Bolt Length	72.44"	-	-	-	-				
Zinc Coating Thick.	503	467	428	486	366	✓			
Hardness Rc 31-39	3507	3420	3337	3482	3247	✓			
Tensile Lot Code	NTA2	NTA3	NTA4	NTA5	NTA6	✓			

TEST SPECIMEN PREPARATION  
AND RECORD

APPROVED FOR USE BY SMTL  
QUALITY MANAGER: *B. Berga*

SM No.  
10-0537

Contract No.  
04-0120F4

Requesting Lab Technician  
Erin

Date Needed  
Routine

TL-0101 No.  
C710103

E.A./Spec. Desg./Object  
04-0120F3

Date Received  
6/2/10

Date Tested/Provided  
6/2/10

<p><input checked="" type="checkbox"/> Machine Shop</p> <p>Work Requested</p> <p><input checked="" type="checkbox"/> standard round tension test specimen, circle one: 0.500"</p> <p><input type="checkbox"/> standard rectangular tension test specimen, circle one: 18" long, 8" gage</p> <p><input type="checkbox"/> Charpy, circle one: 10mm x 10mm</p> <p><input type="checkbox"/> hardness measurement sample (fasteners)</p> <p><input type="checkbox"/> weld nugget</p> <p><input type="checkbox"/> chemistry slug</p> <p><input type="checkbox"/> other: _____</p> <p><input type="checkbox"/> see instructions →</p>	<p>2 A&amp;B</p> <p>3 A&amp;B</p> <p>4 A&amp;B</p> <p>5 A&amp;B</p> <p>6 A&amp;B</p> <p>500s + A Hardness Slug From Each 2-6</p>	<p><input type="checkbox"/> Chemistry Lab</p> <p>type of material: _____</p> <p>Work Requested</p> <p><input type="checkbox"/> neoprene verification</p> <p><input type="checkbox"/> oil swell</p> <p><input type="checkbox"/> zinc coating weight</p> <p><input type="checkbox"/> steel chemistry analysis</p> <p><input type="checkbox"/> other: _____</p> <p>← <input type="checkbox"/> see instructions</p> <p><input type="checkbox"/> Other (explain)</p>
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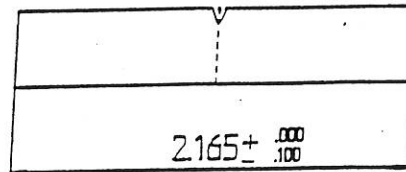
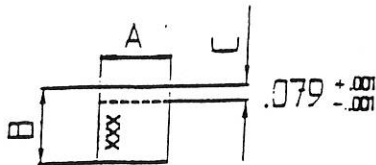
Comments or further instructions	<p>The received service is acceptable</p> <p><i>[Signature]</i> Receiving Lab Technician</p> <p><i>6/3/10</i> Date</p>
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# TRANSLAB

S.M. INSPECTION REPORT FOR HEAT # 6

COMPLETED BY MA  
DATE: 6-3-10



CHARPY IMPACT SPECIMENS

☐ FULL SIZE 10MM X 10MM

☐ REDUCED

MATERIAL  
SURFACE



NOTCH  
ORIENTATION

OK

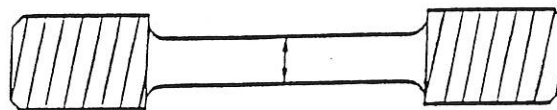
1	
2	
3	

A B C 2.165 .010 R ± .001

1					
2					
3					

NOTE: IMPACT SPECIMENS ARE TO BE GROUND  
TO .394 ± .000 ON SURFACE GRINDER  
ASTM E23 CALLS FOR 45 deg. V NOTCH  
WITH A .010 + or - .001 RADIUS

A DIA.



☒ .500 ± .000

☐ .350 ± .007

☐ OTHER

A DIA. IS

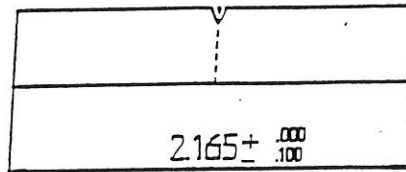
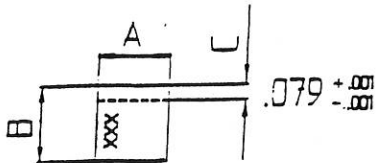
A	.504
B	.502

NOTES / SPECIAL INSTRUCTIONS

# TRANSLAB

S.M. INSPECTION REPORT FOR HEAT # 5

COMPLETED BY ms  
DATE: 6-3-10



CHARPY IMPACT SPECIMENS

☐ FULL SIZE 10MM X 10MM

☐ REDUCED

MATERIAL SURFACE  
  
NOTCH ORIENTATION

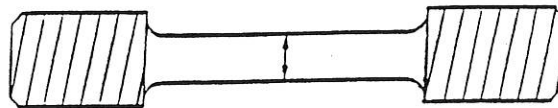
1	OK
2	
3	

A B C 2.165 .010 R ± .001

1					
2					
3					

NOTE: IMPACT SPECIMENS ARE TO BE GROUND TO  $.394 \pm .008$  ON SURFACE GRINDER  
ASTM E23 CALLS FOR 45 deg. V NOTCH WITH A  $.010 \pm .001$  RADIUS

A DIA.



☒  $.500 \pm .010$

☐  $.350 \pm .007$

☐ OTHER

A DIA. IS

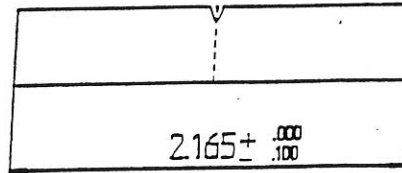
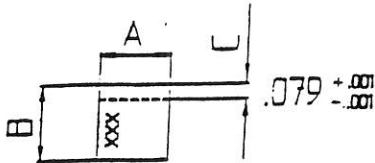
A	.504
B	.5035

NOTES / SPECIAL INSTRUCTIONS

# TRANSLAB

## S.M. INSPECTION REPORT FOR HEAT # 3

COMPLETED BY ms  
DATE: 6-3-10



### CHARPY IMPACT SPECIMENS

☐ FULL SIZE 10MM X 10MM

☐ REDUCED

MATERIAL SURFACE



NOTCH ORIENTATION

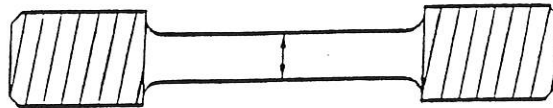
	OK
1	
2	
3	

A B C 2.165 .010 R ± .001

1					
2					
3					

NOTE: IMPACT SPECIMENS ARE TO BE GROUND TO  $.394 \pm .000$  ON SURFACE GRINDER  
ASTM E23 CALLS FOR 45 deg. V NOTCH WITH A  $.010 \pm .001$  RADIUS

A DIA.



☒  $.500 \pm .010$

☐  $.350 \pm .007$

☐ OTHER

A DIA. IS

A	.503
B	.503

NOTES / SPECIAL INSTRUCTIONS

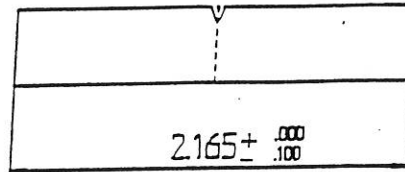
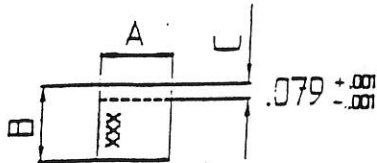


# TRANSLAB

## S.M. INSPECTION REPORT FOR HEAT # 2

COMPLETED BY ms

DATE: 6-3-10



### CHARPY IMPACT SPECIMENS

☐ FULL SIZE 10MM X 10MM

☐ REDUCED

MATERIAL SURFACE



NOTCH ORIENTATION

OK

1	
2	
3	

A B C 2.165 .010 R ± .001

1					
2					
3					

NOTE: IMPACT SPECIMENS ARE TO BE GROUND TO  $.394 \pm .000$  ON SURFACE GRINDER  
ASTM E23 CALLS FOR 45 deg. V NOTCH WITH A  $.010 \pm .001$  RADIUS

A DIA.



☒  $.500 \pm .010$

☐  $.350 \pm .007$

☐ OTHER

A DIA. IS

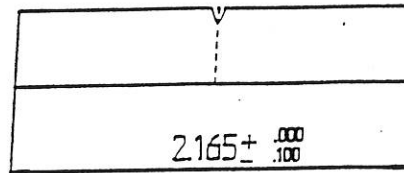
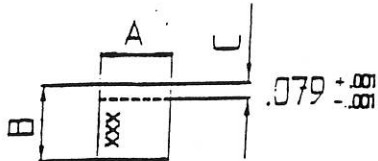
A	.503
B	.503

NOTES / SPECIAL INSTRUCTIONS

# TRANSLAB

S.M. INSPECTION REPORT FOR HEAT # 4

COMPLETED BY MD  
DATE: 6-3-10



CHARPY IMPACT SPECIMENS

☐ FULL SIZE 10MM X 10MM

☐ REDUCED

MATERIAL SURFACE



NOTCH ORIENTATION

OK

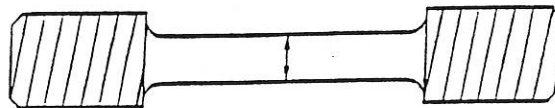
1	
2	
3	

A B C 2.165 .010 R ± .001

1					
2					
3					

NOTE: IMPACT SPECIMENS ARE TO BE GROUND TO  $.394 \pm .000$  ON SURFACE GRINDER  
ASTM E23 CALLS FOR 45 deg. V NOTCH WITH A  $.010 + \text{or} - .001$  RADIUS

A DIA.



☒  $.500 \pm .010$

☐  $.350 \pm .007$

☐ OTHER

A DIA. IS

A	.506
B	.504

NOTES / SPECIAL INSTRUCTIONS

SM 10-0537

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

6/2

MAY 24, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

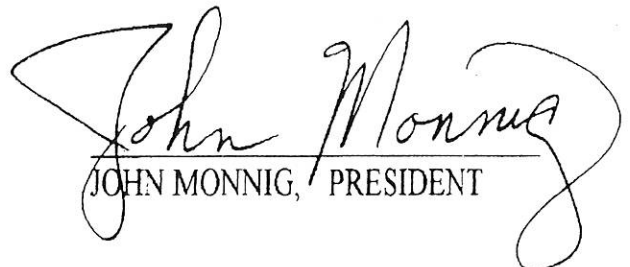
RE: GALVANIZING CERTIFICATE-CALTRAN  
P.O. 72300, 72309, 72285  
5 PCS NTA2-6 4.00" X 72.44" ROUND BAR  
DYSON ORDER# L 106656


THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS.

#### MILL READINGS

6.5	6.0	7.2	8.0
7.9	6.9		

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



# CERTIFIED MATERIAL TEST REPORT

 **DYSON CORP.**

**DTN DOMESTIC NUT**

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106656	660110-SA-017 C/O 019	111 of 111	5 sets	5/19/10

**CUSTOMER**  
American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607  
  
USA

**PRODUCT DESCRIPTION**  
Caltrans sample material  
4.00"-4UNC-2A x 1840mm (72.44") lg. TFL tower saddle tie rod  
(assembly incl. 2 hex full nuts, 1 hex jam nut & 2 washers) w/ hex  
drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans  
Standard Specification 75-1.05 and ASTM-A123 w/ near white metal

**DRAWING**

**SPECIFICATIONS**  
ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	1	NTA2	99882	Timken
Round Bar	3.830	BD	1	NTA3	99882	Timken
Round Bar	3.830	BD	1	NTA4	99882	Timken
Round Bar	3.830	BD	1	NTA5	99882	Timken
Round Bar	3.830	BD	1	NTA6	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

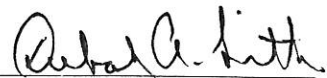
*for QA samples* **STATE OF CALIFORNIA**  
**STOCK MATERIAL**  
*From: Dyson TO: Mannig*  
**LOT NO.** B208-075-10

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**INSPECTOR'S**  
**NAME** SB **DATE** 5/19/10

Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report



Deborah A. Smith  
Q.A. Admin. Assistant

5/19/10

**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002239**Date Inspected:** 04-Jun-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Dyson Corp. & Subs**Location:** Glasgow, MO.**Quality Control Contact:** Ryan Monnig**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** As stated below**Bridge No:** 34-0006**Component:** Suspender System Hardware**Bid Item:** 59**Lot No:** N/A**Summary of Items Observed:**

On this date Quality Assurance (QA) Inspector Terry Hipes was present as requested at Monnig Industries in Glasgow, MO. to observe the grit blasting and galvanizing of suspender system hardware to be used on the San Francisco/Oakland Bay Bridge (SFOBB) project.

At Monnig Industries this QA Inspector met with Mr. Ryan Monnig and was informed that the (26) 4"-4 threaded tie rods received from Dyson Corporation had been grit blasted per SSPC SP10 and hot dipped galvanized per ASTM-A153. Mr. Ryan Monnig stated that not all of the (26) tie rods were ready for QA inspection due to the fact that the threads have not been power wire brushed and the threads verified with a mating nut screwed onto the threads. This QA Inspector randomly observed the (26) 4"-4 threaded tie rods appeared to galvanized. This QA Inspector randomly observed Monnig personnel using files and wire brushes to clean the threads and remove any excessive galvanizing build up on two of the threaded tie rods. Mr. Ryan Monnig stated that he would notify this QA Inspector when all (26) tie rods were completed by power brushing and gaging with the mating nut.

Please see photos attached below.

**Summary of Conversations:**

As noted above

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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### 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 Nina Choy 510-385-5910, who represents the Office of Structural Materials for your project.

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**Inspected By:** Hipes,Terry

Quality Assurance Inspector

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**Reviewed By:** Hager,Craig

QA Reviewer



**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 58.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002240**Date Inspected:** 07-Jun-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 800**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1630**Contractor:** Wire Rope Corp. of America/Houston Structures**Location:** Glasgow, MO.**Quality Control Contact:** Ryan Monnig**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** As stated below**Bridge No:** 34-0006**Component:** Suspender Rope System**Bid Item:** 59 and 68**Lot No:** N/A**Summary of Items Observed:**

On this date Quality Assurance (QA) Inspector Terry Hipes was present as requested at Monnig Industries in Glasgow, MO. to observe the grit blasting and galvanizing of the 75mm type 1, suspender rope sockets that will be used on the San Francisco/Oakland Bay Bridge (SFOBB) project.

At Monnig Industries this QA Inspector met with Mr. Ryan Monnig and was informed that (42) 75mm type 1, suspender rope sockets have been received from Dyson Corporation. Mr. Ryan Monnig stated that the 75mm sockets are scheduled to be grit blasted per SSPC-SP10 at Phoenix Manufacturing Inc. and galvanized on 06-09-10.

Mr. Ryan Monnig also stated that if the grit blasting and galvanizing schedule changes he would notify this QA Inspector of the changes. This QA inspector inquired about the progress of the (26) galvanized 4"-4 threaded tie rods with Mr. Ryan Monnig and he stated that only (11) of the (26) have been power brushed and gaged with the mating nut. This QA Inspector did a random observation of the (11) tie rods and they visually appeared to have been power wire brushed. Mr. Ryan Monnig stated that no other SFOBB production work is being performed on this date.

**Summary of Conversations:**

As noted above.

**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 Nina Choy 510-385-5910, who represents the Office of Structural Materials for your project.

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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**Inspected By:** Hipes,Terry

Quality Assurance Inspector

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**Reviewed By:** Hager,Craig

QA Reviewer

**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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002286**Date Inspected:** 15-Jun-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 700**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1530**Contractor:** Dyson Corp. & Subs**Location:** Glasgow, MO.

**Quality Control Contact:** Ryan Monnig  
**Material transfer:** Yes No N/A  
**Stock Transfer:** Yes No N/A  
**Rebar Test Witness:** Yes No N/A

**Quality Control Present:** Yes No  
**Sampled Items:** Yes No N/A  
**OK to Cut:** Yes No N/A  
**Delayed/Cancelled:** Yes No N/A

**Other:** As stated below**Bridge No:** 34-0006**Component:** Suspender Rope System**Bid Item:** 68**Lot No:** N/A**Summary of Items Observed:**

On this date Quality Assurance (QA) Terry Hipes was present as requested at Monnig Industries in Glasgow, MO. to observe the grit blasting and galvanizing of the 75 mm type 1, suspender sockets that will be used on the SAN Francisco/Oakland Bay Bridge (SFOBB) project.

At Monnig Industries this QA Inspector met with Mr. Ryan Monnig and was informed that Monnig Industries is in progress of grit blasting, masking the threads and galvanizing (10) of (99) 75mm suspender sockets. Mr. Ryan Monnig stated that they plan to grit blast, mask and galvanized (10) sockets at a time for better control of the masking of the threads. This QA Inspector observed Monnig personnel covering the (10) sockets with a tarp (due to rain) before moving the sockets from the blasting facility into Monnig's facility. This QA Inspector randomly observed the outside surfaces of the (10) grit blast sockets and the sockets appeared to be in compliance with SSPC-SP10. This QA Inspector randomly observed Monnig personnel applying silicone to the 3/8"-16 and 3.5"-4 threads. This QA Inspector did a random visual inspection of the masking and noted that the masking appeared to have full coverage in the threads before galvanizing. Please see photos attached below.

NOTE: The first lot of (42) 75mm sockets that Monnig Industries galvanized will need to have the 3.5"-4 threads chased with tap to remove galvanizing in the threads.

This QA Inspector pointed out to Mr. Ryan Monnig that (13) of the (26) 4"-4 tie rods have not had the excessive galvanize build up removed from the threads. Mr. Ryan Monnig agreed with this QA Inspector and stated that he would have his personnel clean up the threads.

**Summary of Conversations:**

As noted above

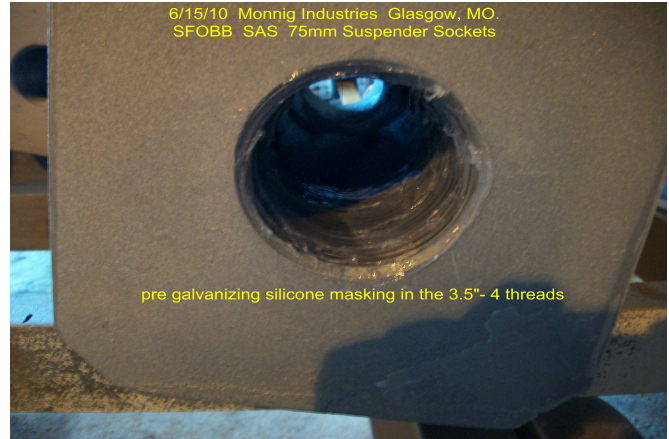


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# SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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## Comments

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**Inspected By:** Hipes,Terry

Quality Assurance Inspector

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**Reviewed By:** Hager,Craig

QA Reviewer

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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.15**SOURCE INSPECTION REPORT****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** SIR-002454**Date Inspected:** 02-Jul-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 700**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1530**Contractor:** Dyson Corp. & Subs**Location:** Glasgow, MO.**Quality Control Contact:** Ryan Monnig**Quality Control Present:** Yes No**Material transfer:** Yes No N/A**Sampled Items:** Yes No N/A**Stock Transfer:** Yes No N/A**OK to Cut:** Yes No N/A**Rebar Test Witness:** Yes No N/A**Delayed/Cancelled:** Yes No N/A**Other:** As stated below**Bridge No:** 34-0006**Component:** Suspender System**Bid Item:** 59**Lot No:** See below**Summary of Items Observed:**

On this date Quality Assurance (QA) Inspector Terry Hipes was present at Monnig Industries in Glasgow, MO. for the release of 4"-4, TFL tower saddle tie rod assemblies that will be used on the San Francisco/Oakland Bay Bridge (SFOBB) project.

At Monnig Industries Mr. Ryan Monnig provided this QA Inspector with the contractors Certificate of Compliance (COC) for the grit blasting and galvanizing and the supporting documents for the (26) 4"-4 UNC-2A x various lengths of tower saddle tie rods. This QA Inspector confirmed the Structural Materials Testing Laboratory test results for lot codes NTA2, NTA3, NTA4, NTA5 and NTA6 are satisfactory for use (SM-10-0537).

This QA Inspector reviewed the documents and they appeared to comply with the contract requirements. This QA Inspector did a random visual inspection of the tie rods as they were presented and they appeared to be in good shape and have the Lot Code stamped on the ends. The materials and documentation appeared to comply with the contract requirements and this QA Inspector issued Orange tags with the followings Caltrans Lot Numbers, B304-021-10, B304-022-10, B304-023-10, B304-024-10, B304-025-10, B304-026-10, B304-027-10, B304-028-10, B304-029-10, B304-030-10, B304-031-10 and B304-032-10.

Mr. Ryan Monnig stated that Monnig Industries has received the Washers, Nuts, and Jam Nuts for the Tie Rods from Dyson and are to be shipped with the Tie Rods as a set. Mr. Ryan Monnig provided this QA Inspector with the green tag documents for (100) 4" Harden Flat Washers (Lot Code NQF), (100) 4"-4 Heavy Hex Nuts (Lot Code NNH) and (98) 4"-4 Heavy Hex Jam Nuts (Lot Code NNJ). This QA Inspector confirmed the Structural Materials Testing Laboratory test results for Lot Codes NQF, NNH, and NNJ are satisfactory for use (SM-10-0629, SM-10-0630 and SM-10-0631). This QA Inspector reviewed the green tag documents supplied with the Washers,

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## SOURCE INSPECTION REPORT

( Continued Page 2 of 2 )

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Nuts and Jam Nuts and the documents appeared to comply with the contract requirements. This QA Inspector issued Orange tags with the following Caltrans Lot Numbers, B304-033-10 for (98) 4"-4 Heavy Hex Jam Nuts (Lot Code NNJ), B304-034-10 for (100) 4"-4 Heavy Hex Nuts (Lot Code NNH) and B304-035-10 for (100) 4" Hardened Flat Washers (Lot Code NQF).

Please see the Report of Inspection of Material (TL-29) on this date for more detailed information.

### Summary of Conversations:

As noted above

### 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 Nina Choy 510-385-5910, who represents the Office of Structural Materials for your project.

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<b>Inspected By:</b>	Hipes,Terry	Quality Assurance Inspector
<b>Reviewed By:</b>	Hager,Craig	QA Reviewer

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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 #: 04-0120F4Cty: SF/ALA Rte: 80 PM: 13.2/13.9File #: 76.9**REPORT OF INSPECTION OF MATERIAL****Resident Engineer:**Pursell, Gary**Address:** 333 Burma Road**City:** Oakland, CA 94607**Report No:** RIM-000046**Date Inspected:** 02-Jul-2010**Project Name:** SAS Superstructure**OSM Arrival Time:** 700**Prime Contractor:** American Bridge/Fluor Enterprises, a JV**OSM Departure Time:** 1530**Contractor:** Dyson Corp. & Subs**Location:** Glasgow. MO.

The following material has been inspected in accordance with Section 6 of the Standard Specifications and found to substantially comply\* with contract plans and specifications.

Item	Lot #	Bid Item#	Quantity	Material Description
1	B304-021-10	59	2	4"-4 UNC-2A x 1840mm TFL Tie Rod, HDG, Lot Code NTA5, Heat #99882
2	B304-022-10	59	1	4"-4 UNC-2A x 5185mm TFL Tie Rod, HDG, Lot Code NTA2, Heat #99882
3	B304-023-10	59	1	4"-4 UNC-2A x 4860mm TFL Tie Rod, HDG, Lot Code NTA5, Heat #99882
4	B304-024-10	59	2	4"-4 UNC-2A x 4755mm TFL Tie Rod, HDG, Lot Code NTA2, Heat #99882
5	B304-025-10	59	2	4"-4 UNC-2A x 4635mm TFL Tie Rod, HDG, Lot Code NTA2, Heat #99882
6	B304-026-10	59	3	4"-4 UNC-2A x 4475mm TFL Tie Rod, HDG, Lot Code NTA4, Heat #99882
7	B304-027-10	59	3	4"-4 UNC-2A x 4310mm TFL Tie Rod, HDG, Lot Code NTA5, Heat #99882
8	B304-028-10	59	1	4"-4 UNC-2A x 4580mm TFL Tie Rod, HDG, Lot Code NTA4, Heat #99882
9	B304-029-10	59	1	4"-4 UNC-2A x 5035mm TFL Tie Rod, HDG, Lot Code NTA4, Heat #99882
10	B304-030-10	59	3	4"-4 UNC-2A x 4175mm TFL Tie Rod, HDG, Lot Code NTA6, Heat #99882
11	B304-031-10	59	5	4"-4 UNC-2A x 4090mm TFL Tie Rod, HDG, Lot Code NTA3, Heat #99882
12	B304-032-10	59	2	4"-4 UNC-2A x 5325mm TFL Tie Rod, HDG, Lot Code NTA6, Heat #99882
13	B304-033-10	59	98	4"-4 UNC-2B Heavy Hex Jam Nut, Lot Code NNJ, Heat #A085940
14	B304-034-10	59	100	4"-4 UNC-2B Heavy Hex Nut, Lot Code NNH, Heat #A085839

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## REPORT OF INSPECTION OF MATERIAL

( Continued Page 2 of 2 )

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15	B304-035-10	59	100	4" Hardened Flat Washer, Lot Code NQF, Heat #F0214
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**Identification:** Orange attached to the material

**Shipped to:** Job Site in  
Oakland

**Summary of Items Observed:**

Quality Assurance (QA) Inspector Terry Hipes was present as requested at Monnig Industries in Glasgow, MO. for the release of material as listed above.

At Monnig Industries this QA Inspector met with Mr. Ryan Monnig and was provided with the contractors Certificate of Compliance (COC) for grit blasting and galvanizing and the supporting documents for (26) 4"-4 UNC-2A x various lengths (listed above) of threaded TFL tower saddle tie rods with the following lot codes, NTA2, NTA3, NTA4, NTA5 and NTA6. This QA Inspector confirmed the Structural Materials Testing Laboratory tests results for lot codes NTA2, NTA3, NTA4, NTA5, and NAT6 are satisfactory for use (SM-10-0537). This QA Inspector reviewed the contractors COC and the supporting documents and they appeared to comply with the contract requirements. This QA Inspector did a random visual inspection of the materials as they were present and noted that they appeared to be in good shape with lot codes stamped on the ends. This QA Inspector issued (12) Orange tags for the (26) 4"-4 threaded tie rods with Caltrans Lot Numbers listed above.

Mr. Ryan Monnig stated that Dyson Corporation sent (100) 4" Hardened Flat Washers (Lot Code NQF), (100) 4"-4 Heavy Hex Nuts (lot code NNH) and (98) 4"-4 Heavy Hex Jam Nuts (Lot Code NNJ) for staging and are to be shipped with the (26) tie rods. Mr. Ryan Monnig provided this QA Inspector with the green tag documents for the washers, nuts and jam nuts. This QA Inspector confirmed the Structural Material Test Laboratory test results for Lot Codes NQF, NNH and NNJ are satisfactory for use (SM-10-0629, SM-10-0630 and SM-10-0631) This QA Inspector reviewed the green documents supplied with the washers, nuts and jam nuts and noted that the documents appeared to comply with the contract requirements. This QA Inspector issued three Orange tags for the washers, nuts and jam nuts listed above and attached them to the boxes of material.

**Summary of Conversations:**

As noted above.

**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 Nina Choy (510) 385-5910, who represents the Office of Structural Materials for your project.


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<b>Inspected By:</b>	Hipes, Terry	Quality Assurance Inspector
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<b>Reviewed By:</b>	Hager, Craig	QA Reviewer
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# CERTIFIED MATERIAL TEST REPORT

 **DYSON CORP.**  
**DTN DOMESTIC NUT**

**53 Freedom Road  
Painesville, OH 44077**

**440-946-3500  
440-352-2700 fax**

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
<b>L 106599</b>	<b>660110-SA-017 C/O 019</b>	<b>63 of 111</b>	<b>2 sets</b>	<b>5/19/10</b>

**CUSTOMER**  
**American Bridge / Fluor JV**  
375 Burma Road  
Oakland, CA 94607  
  
**USA**

**PRODUCT DESCRIPTION**  
4.00"-4UNC-2A x 1840mm (72.44") lg. TFL tower saddle tie rod  
(assembly incl. 2 hex full nuts, 1 hex jam nut & 2 washers) w/hex  
drive on one end per Dwg. JSW-TS-017. HDG per Caltrans Standard  
Specification 75-1.05 and ASTM-A123 w/near white metal blast  
prior to galvanizing. Tower Saddle Tie Rod Assembly - Group 1

**DRAWING**

**SPECIFICATIONS**  
**ASTM-A354 Grade BD with special provisions**  
**10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05**

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	2	NTA5	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

*B304-021-10*  
*TH 7/2/10*

**STATE OF CALIFORNIA  
STOCK MATERIAL**

*From: Dyson To: Manning*


**LOT NO.** B208-D74-10

**INSPECTOR'S**

**NAME** SB **DATE** 5-19-10

**Attachments:**

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

  
**Deborah A. Smith**  
Q.A. Admin. Assistant  
5/19/10



# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

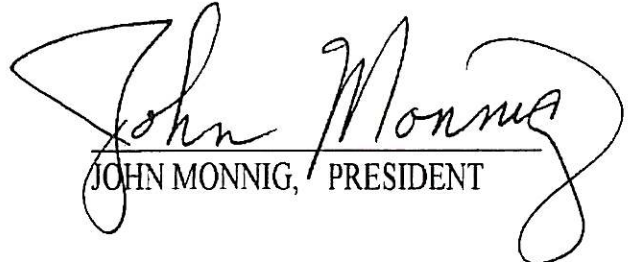
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106599  
2 PCS 4" -4UNC-2A X 1840MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

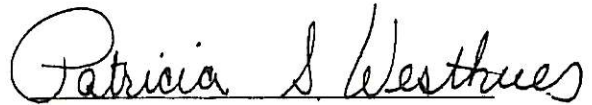
5.5	6	6.5	7
5	7.5	7	6.5

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-021-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106599

2 EA 4" -4UNC-2A x 1840MM LG

  
KIRBY NORRIS

B304-021-10  
TH 7/2/10

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTAS

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2.
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

SPEC: Grain Size (Info Only) SIZE FINE

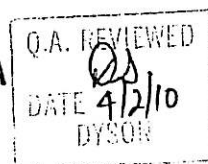
Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-074-10

NAME: SB 5-19-10



B304-021-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_

NOTARY PUBLIC

by

*Susan Bender*  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION



Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA5

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



B304-021-10  
TH 7/2/10



STATE OF CALIFORNIA

LOT NO: B208-074-10

NAME: SB 5-19-10

THE TIMKEN CORPORATION



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

## TEST REPORT

REPORT NO: 147670

DATE: MARCH 17, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTAS

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6150 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67122
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	130.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	42.0	
SURF HB	HBW	293 363	327 329	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secq		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 08:17

\*Not included in our scope of accreditation

Phil Burgdorf  
Test Center Tech II

B304-021-10  
TH 7/2/10

FC 4.12.16F 10/12/09



STATE OF CALIFORNIA

LOT NO: B208-074-10

NAME: SB 5-19-10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle exam on Tower Saddle Tie Rods, Performed On-Site w/Caltran Witness.

**MAGNETIC PARTICLE INSPECTION REPORT**

Standard:		ASTM -F788	
Procedure:		SOP 42.03	
METHOD			
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet	
PARTICLES			
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K		<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	
		<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration    MI Batch No.	
CURRENT			
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC	
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)	
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)	
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe			
EQUIPMENT			
<input type="checkbox"/> Magnaflux H-720		S/N: 81471    Cal Due Date:	
<input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC    S/N: 9432    Spacing: 4" - 6"    Cal Due Date: 8/11/10			

B304-021-10  
TH 7/2/10



STATE OF CALIFORNIA

LOT NO: B208-074-10

NAME: SB 5-19-10

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager



5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1


**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS		Results
L106599 Qty 2 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106656 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106656 Qty 1 A354 BD NTA3 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106656 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106656 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106656 Qty 1 A354 BD NTA6 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod		ACCEPTABLE
L106628 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4635 182.48" Tower Saddle Tie Rod		ACCEPTABLE
L106633 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4755 187.2" Tower Saddle Tie Rod		ACCEPTABLE
L106646 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 5185 204.13" Tower Saddle Tie Rod		ACCEPTABLE
L106618 Qty 3 A354 BD NTA4 #99882 4" 4Pitch 4475 176.18" Tower Saddle Tie Rod		ACCEPTABLE
L106637 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 4860 191.34" Tower Saddle Tie Rod		ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/17/10 + 5/18/10 <i>21x</i>		
Marking Requirements:		
Demag and post cleaning requirements:		
Inspected by: <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III	

EXPORT CONTROLLED (ITAR)  
THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR OTHER APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.

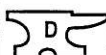
*B304-021-10*  
*TH 7/2/10*

 **STATE OF CALIFORNIA**  
LOT NO: *B208-074-10*  
NAME: *5-19-10*

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or international test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*  
Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT



**DYSON CORP.**

**DTN DOMESTIC NUT**

**53 Freedom Road  
Painesville, OH 44077**

**440-946-3500  
440-352-2700 fax**

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106605	660110-SA-017 C/O 019	63 of 111	5 sets	5/21/10

**CUSTOMER**

**American Bridge / Fluor JV**  
375 Burma Road  
Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 4090mm (161.03") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	5	NTA3	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

*B304-031-10  
TH 7/2/10*

**STATE OF CALIFORNIA  
STOCK MATERIAL**

*From: Dyson TO: Monnig*

**LOT NO. *B208-085-10***

---

**INSPECTOR'S**

**NAME *SB*      DATE *5-21-10***

**Attachments:**

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

Deborah A. Smith

Q.A. Admin. Assistant  
5/21/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

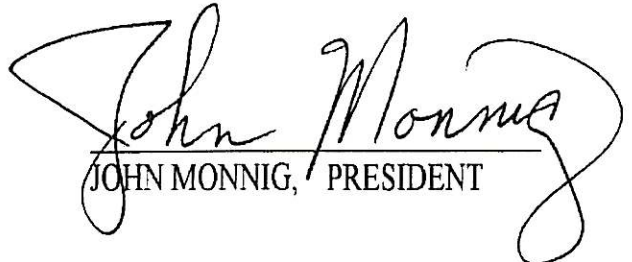
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106605  
5 PCS 4" -4UNC-2A X 4090MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

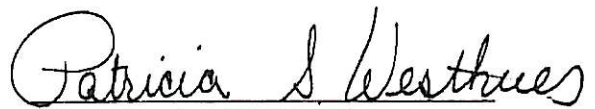
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7	7	7.5	6.5
6	6.5	6.5	6

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-031-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC





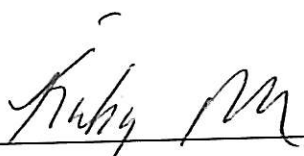
Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106605

5 EA 4" -4unc-2A x 4090MM LG

  
KIRBY NORRIS

B304-031-10  
TH 7/2/10

Jan. 5. 2010 12:13PM MET LAB

# Steel Certificate of Test

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3

# TIMKEN

Where You Turn

01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA3

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

## Description of Material

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

## Specification

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

## Chemistry Information

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

## Metallurgy Information

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6



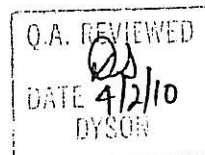
STATE OF CALIFORNIA

SPEC: Grain Size (Info Only) SIZE

Heat 99882 SIZE: 7

LOT NO: B208-085-10

NAME: SB S-21-10



B304-031-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_

NOTARY PUBLIC

by

*Susan Bender*

Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA3

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

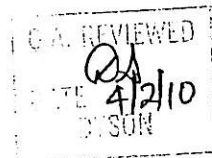
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-08510

NAME: SB S-21-10



B304-031-10  
TH 7/2/10





**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

**TEST REPORT**  
REPORT NO: 147672  
DATE: MARCH 15, 2010  
PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA 3

DESC: 6 PCS	4"RD X 23"6	HEAT#: 98882	GRADE: 4140	WT: 6146 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67120
SPEC: QUENCH, TEMPER, STRAIGHTEN	ASTM-A354-BD-07A			
AIM-33/37 RC @ SURFACE				
PROCESS:	FURN TEMP: 1600	FURN TIME hh.mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh.mm: 4.00		
	STRESS TEMP:	STRESS TIME hh.mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	156.0	
YIELD .2%	KSI	115 N/A	130.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	47.0	
SURF HB	HBW	293 363	341 346	

TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secn		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 10:52

\*Not included in our scope of accreditation

Ken Rueff  
Test Center Supervisor



STATE OF CALIFORNIA

FC 4.12.16F 10/12/09

LOT NO: B208-085-10  
NAME: SB 5-21-10

B304-031-10  
TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center

5/21/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-3

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA


Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle Inspection of Tower Saddle Tie Rods  
On-Site Testing 5-20-10

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b>	ASTM -F788		
<b>Procedure:</b>	SOP 42.03		
<b>METHOD</b>			
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet	
<b>PARTICLES</b>			
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K		<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	
		<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration    MI Batch No.	
<b>CURRENT</b>			
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC	
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)	
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)	
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe			
<b>EQUIPMENT</b>			
 STATE OF CALIFORNIA Cal Due Date:			
<input type="checkbox"/> AC <input checked="" type="checkbox"/> DC    S/N: 9432    Spacing: 4" - 6"    Cal Due Date: 8/11/10			

LOT NO: B208-085-10

B304-031-10

NAME: SB 5-21-10

TH 7/2/10

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Karen Baumiller  
Customer Services Manager

5/21/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-3

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106605 Qty 5 A354 BD NTA3 #99882 4" 4Pitch 4090 161.02" Tower Saddle Tie Rod	ACCEPTABLE
L106651 Qty 2 A354 BD NTA6 #99882 4" 4Pitch 5325 209.65" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/20/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

**EXPORT CONTROLLED (ITAR)**

THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE UNITED STATES. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.

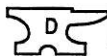
LOT NO: B208-085-10  
NAME: SB 5-21-10

B304-031-10  
TH 7/2/10

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*Karen Baumiller*  
Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT



DYSON CORP.

DTN DOMESTIC NUT

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106609	660110-SA-017 C/O 019	71 of 111	3 sets	5/20/10

## CUSTOMER

American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607

USA

## DRAWING

## PRODUCT DESCRIPTION

4.00"-4UNC-2A x 4175mm (164.37") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

## SPECIFICATIONS

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	3	NTA6	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-030-10  
TH 7/2/10

STATE OF CALIFORNIA  
STOCK MATERIAL

From: Dyson TO: Monnig

LOT NO. B208-084-10

INSPECTOR'S

NAME SB DATE 5-20-10

## Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

Deborah A. Smith

Q.A. Admin. Assistant

5/20/10



# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

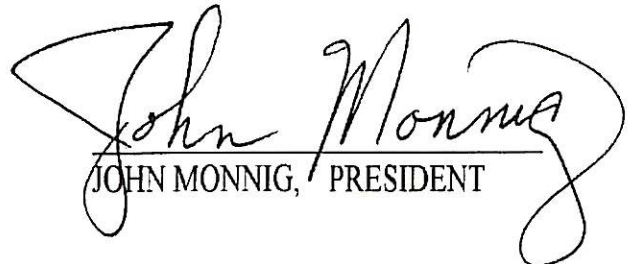
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106609  
3PCS 4" -4UNC-2A X 4175MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

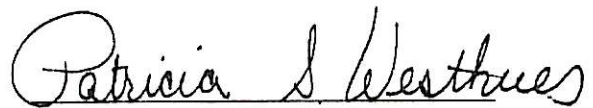
7	7.5	6.5	6.5
6	5.5	6.5	7
7	6.5	5.5	6

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-030-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554  
\* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106609

3 EA 4" -4UNC-2A X 4175MM LG.

B304-030-10

TH 7/2/10

KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA6

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

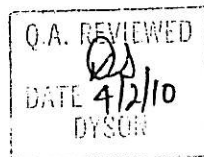
SPEC: Grain Size (Info Only) SIZE FINE

Heat 99882 SIZE: 7

 STATE OF CALIFORNIA

LOT NO: B208-084-10

NAME: SB 5-20-10



B304-030-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved:

NOTARY PUBLIC

by

  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUBBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA6

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

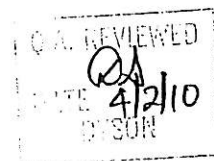
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-084-10

NAME: SB 5-20-10



B304-030-10  
TH 7/2/10





**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

**TEST REPORT**  
REPORT NO: 147668  
DATE: MARCH 15, 2010  
PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA6


DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6139 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67123
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	158.0	
YIELD .2%	KSI	115 N/A	132.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	45.0	
SURF HB	HBW	293 363	306 310	

TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secn		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 10:49

\*Not included in our scope of accreditation

  
Ken Rueff  
Test Center Supervisor



FC 4.12.16F 10/12/09

LOT NO: B208-084-10  
NAME: SB 5-20-10

B304-030-10  
TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

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5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle Inspection of 4" Tower Saddle Tie Rods, On-Site  
Testing 5-19-10

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b>	ASTM -F788	
<b>Procedure:</b>	SOP 42.03	
<b>METHOD</b>		
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet
<b>PARTICLES</b>		
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K	<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration    MI Batch No.
<b>CURRENT</b>		
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe		
<b>EQUIPMENT</b>		
<input type="checkbox"/> Magnaflux H-720    S/N:    Cal Due Date: <input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC    S/N: 9432    Spacing: 4" - 6"    Cal Due Date: 8/11/10		



STATE OF CALIFORNIA

LOT NO: B208-084-10

B304-030-10  
TH 7/2/10

NAME: SB S-20-10

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*Karen Baumbler*

Karen Baumbler  
Customer Services Manager

5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106623 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 4580 180.31" Tower Saddle Tie Rod	ACCEPTABLE
L106641 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 5035 198.23" Tower Saddle Tie Rod	ACCEPTABLE
L106613 Qty 3 A354 BD NTA5 #99882 4" 4Pitch 4310 169.69" Tower Saddle Tie Rod	ACCEPTABLE
L106609 Qty 3 A354 BD NTA6 #99882 4" 4Pitch 4175 164.37" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906, ABF-RFI-001741R01 & CCO 91 Report for 5/19/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

**EXPORT CONTROLLED (ITAR)**

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LOT NO: B208-084-10

NAME: SB S-20-10

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*B304-030-10*  
*TH 7/2/10*

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DTN DOMESTIC NUT**

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106613	660110-SA-017 C/O 019	75 of 111	3 sets	5/20/10

**CUSTOMER**  
American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607  
USA  
**DRAWING**

**PRODUCT DESCRIPTION**  
4.00"-4UNC-2A x 4310mm (169.69") lg. TFL tower saddle tie rod  
(assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex  
drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans  
Standard Specification 75-1.05 and ASTM-A123 w/ near white metal  
blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group  
**SPECIFICATIONS**  
ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	3	NTA5	99882	Timken


The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-027-10  
TH 7/2/10

**STATE OF CALIFORNIA  
STOCK MATERIAL**  
From: Dyson To: Mannig  
**LOT NO. B208-081-10**  
**INSPECTOR'S**  
**NAME SB DATE 5-20-10**

Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

  
Deborah A. Smith  
Q.A. Admin. Assistant  
5/20/10



# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

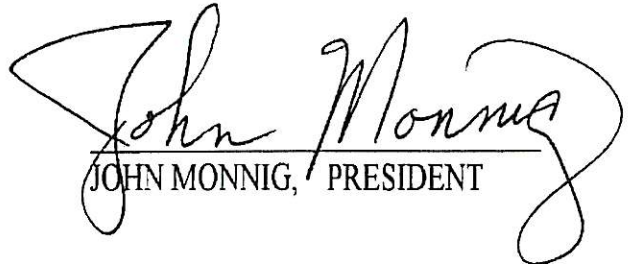
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106613  
3 PCS 4" -4UNC-2A X 4310MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

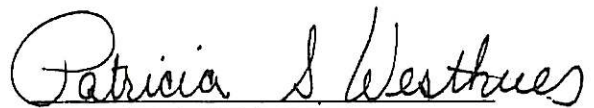
6	6.5	7	6.5
5.5	6	6.5	6
7	7.5	6.5	7

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-027-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106613

3 EA 4" -4UNC-2A X 4310MM LG

B304-027-10

TH 7/2/10

  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA5

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

SPEC: Grain Size (Info Only) SIZE FINE

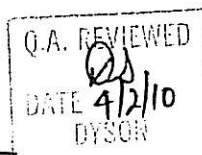
Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-081-10

NAME: SB 5-20-10



B304-027-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_  
NOTARY PUBLIC

by

Susan Bender  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTAS

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	11	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-081-10

NAME: SB S-20-10

B304-027-10

TH 7/2/10

THE TIMKEN CORPORATION





**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

## TEST REPORT

REPORT NO: 147670

DATE: MARCH 17, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA5

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6150 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67122
SPEC: :QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP : 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	130.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	42.0	
SURF HB	HBW	293 363	327 329	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis* Decarb Measure Chemistry*
Tensile, Full Secn		Brinell	
Charpy V 10mmx10mm		Ultra Sonic*	
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 08:17

\*Not included in our scope of accreditation

Phil Burgdorf  
Test Center Tech II



STATE OF CALIFORNIA

FC 4.12.16F 10/12/09

LOT NO: B208-081-10

NAME: SB S-20-10

B304-027-10  
TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center.

5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106623 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 4580 180.31" Tower Saddle Tie Rod	ACCEPTABLE
L106641 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 5035 198.23" Tower Saddle Tie Rod	ACCEPTABLE
L106613 Qty 3 A354 BD NTA5 #99882 4" 4Pitch 4310 169.69" Tower Saddle Tie Rod	ACCEPTABLE
L106609 Qty 3 A354 BD NTA6 #99882 4" 4Pitch 4175 164.37" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906, ABF-RFI-001741R01 & CCO 91 Report for 5/19/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

**EXPORT CONTROLLED (ITAR)**

THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR OTHER APPROVAL IS PROHIBITED.



STATE OF CALIFORNIA

LOT NO: B208-081-10

B304-027-10  
TH 7/2/10

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DOMESTIC NUT**

53 Freedom Road  
 Painesville, OH 44077

440-946-3500  
 440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106618	660110-SA-017 C/O 019	79 of 111	3 sets	5/19/10

**CUSTOMER**  
 American Bridge / Fluor JV  
 375 Burma Road  
 Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 4475mm (176.18") lg. TFL tower saddle tie rod assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
 10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	3	NTA4	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

*B304-026-10*  
*TH 7/2/10*

**STATE OF CALIFORNIA  
 STOCK MATERIAL**

*From: Dyson To: Moonig*  
**LOT NO. B208-080-10**

**INSPECTOR'S**

**NAME SB DATE 5-19-10**

Attachments:

Mill Test Report  
 Mechanical Test Report  
 N.D.E. Report



Deborah A. Smith  
 Q.A. Admin. Assistant  
 5/19/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

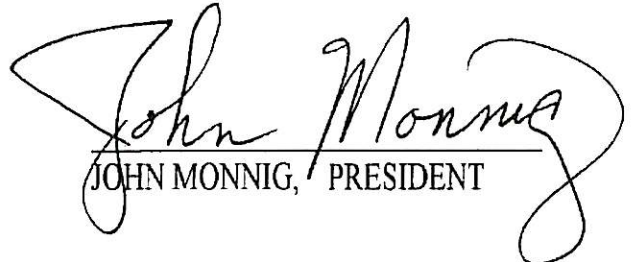
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106618  
3 PCS 4" -4UNC-2A X 4475MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

6.5	7	7.5	6
7.5	6.5	7	6.5
6	6.5	7	6

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

## INSPECTION RELEASE TAG

TL-0624 (REV. 10/03)


STATE LOT NO. B304-026-10

CONTRACT NO. 04-0120F4

RELEASED (\*) BY TH DATE 7/2/10

FM 92 1554

\* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC





Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106618

3 EA 4" -4UNC-2A X 4475MM LG.

B304-026-10  
TH 7/2/10

  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTAT

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255

SPEC: Grain Size (Info Only)

Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-080-10

NAME: SB 5-19-10



B304-026-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_

NOTARY PUBLIC

by

*Susan Bender*

Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA4

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 28599-2

Customer Part Number:

Timken Order: 15743-A (1615680)

Heat Number(s):

99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		

99882 A1-01: 58 57 57 56 55 55 54 54 53 51 49 46 44 42 42 40 39 38 38 37

Heat 99882 Melt Source: USA

Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-080-10

NAME: SB 5-19-10

B304-026-10

TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



**TEST REPORT**  
REPORT NO: 147671  
DATE: MARCH 15, 2010  
PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15128-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15128-1142

CODE NTAA

DESC: 6 PCS	4"RD X 23'6"	HEAT#: 99882	GRADE: 4140	WT: 6137 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67121
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1800	FURN TIME hh.mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh.mm: 4.00		
	STRESS TEMP:	STRESS TIME hh.mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	156.0	
YIELD .2%	KSI	115 N/A	131.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	44.0	
SURF HB	HBW	293 363	341 335	

TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell		Micro Analysis*
Tensile, Full Secn		Brinell	TC	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*		Chemistry*
Microhardness, Knoop*				
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services		
Cert #1281-01	Cert #L1157-1	Cert #0510		
2/28/11	2-4-2011	12/31/10		

TIME 10:50

\*Not included in our scope of accreditation

Ken Rueff  
Test Center Supervisor

FC 4.12.18F 10/12/09



STATE OF CALIFORNIA

LOT NO: B208-080-10

NAME: SB 5-19-10

B304-026-10  
TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center



5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106599 Qty 2 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA3 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA6 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106628 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4635 182.48" Tower Saddle Tie Rod	ACCEPTABLE
L106633 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4755 187.2" Tower Saddle Tie Rod	ACCEPTABLE
L106646 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 5185 204.13" Tower Saddle Tie Rod	ACCEPTABLE
L106618 Qty 3 A354 BD NTA4 #99882 4" 4Pitch 4475 176.18" Tower Saddle Tie Rod	ACCEPTABLE
L106637 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 4860 191.34" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/17/10 + 5/18/10 <i>21X</i>	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

EXPORT CONTROLLED (ITAR)  
THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF  
THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS  
OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN  
ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR  
APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.



STATE OF CALIFORNIA

LOT NO: B208-080-10  
NAME: SB S-19-10

*B304-026-10*  
*TH 7/2/10*

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumbler*

Karen Baumbler  
Customer Services Manager

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle exam on Tower Saddle Tie Rods, Performed On-Site w/Caltran Witness.

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b> ASTM -F788	
<b>Procedure:</b> SOP 42.03	
<b>METHOD</b>	
<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Wet
<b>PARTICLES</b>	
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K	<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other
<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration MI Batch No.	
<b>CURRENT</b>	
<input type="checkbox"/> AC	<input type="checkbox"/> FWDC
<input type="checkbox"/> Central Conductor (AMPS)	<input type="checkbox"/> Head Shot (AMPS)
<input type="checkbox"/> Coil (AMPS)	<input type="checkbox"/> Prods (AMPS/Spacing)
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe	
<b>EQUIPMENT</b>	
<input type="checkbox"/> Magnaflux H-720 S/N: 81471 Cal Due Date:	
<input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC S/N: 9432 Spacing: 4" - 6" Cal Due Date: 8/11/10	



STATE OF CALIFORNIA

LOT NO: B208-080-10

NAME: SB 5-19-10

B304-026-10  
TH 7/2/10

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*Karen Baumliller*

Karen Baumliller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT



DYSON CORP.

DTN DOMESTIC NUT

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106623	660110-SA-017 C/O 019	83 of 111	1 set	5/20/10

**CUSTOMER**

American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 4580mm (180.32") lg. TFL tower saddle tie rod  
(assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex  
drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans  
Standard Specification 75-1.05 and ASTM-A123 w/ near white metal  
blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	1	NTA4	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-028-10  
TH 7/2/10

## STATE OF CALIFORNIA STOCK MATERIAL

From: Dyson To: Mannig

LOT NO. B208-082-10

INSPECTOR'S

NAME GB DATE 5-20-10

**Attachments:**

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

Deborah A. Smith  
Q.A. Admin. Assistant

5/20/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

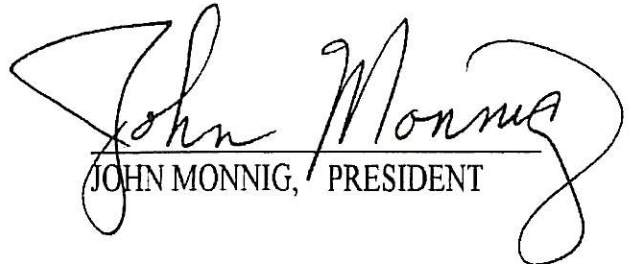
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106623  
1PC 4" -4UNC-2A X 4580MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

6.5	7	7.5	6.5
-----	---	-----	-----

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-028-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC





Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106623

1 EA 4" -4UNC-2A X 4580MM LG.

B304-028-10  
TH 7/2/10

  
\_\_\_\_\_  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA4

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25



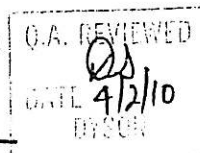
STATE OF CALIFORNIA

SPEC: Grain Size (Info Only) SIZE FINE

Heat 99882 SIZE: 7

LOT NO: B208-0A2-10

NAME: SB S-20-10



B304-028-10  
TH 7/10/TH  
7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_

NOTARY PUBLIC

by

*Susan Bender*

Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA4

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

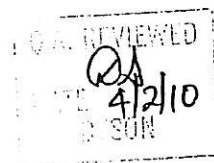
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-082-10

NAME: SB 5-20-10



B304-028-10  
TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

## TEST REPORT

REPORT NO: 147671

DATE: MARCH 15, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTAA

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6137 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67121
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1800	FURN TIME hh.mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh.mm: 4.00		
	STRESS TEMP:	STRESS TIME hh.mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	156.0	
YIELD .2%	KSI	115 N/A	131.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	44.0	
SURF HB	HBW	293 363	341 335	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell		Micro Analysis*
Tensile, Full Secn		Brinell	TC	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*		Chemistry*
Microhardness, Knoop*				
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services		
Cert #1281-01	Cert #L1157-1	Cert #0510		
2/28/11	2-4-2011	12/31/10		

TIME 10:50

\*Not included in our scope of accreditation



STATE OF CALIFORNIA

*Ken Rueff*

Ken Rueff  
Test Center Supervisor

LOT NO: B208-082-10

NAME: SB 5-20-10

B304-028-10  
TH 7/2/10

FC 4.12.16F 10/12/09

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center



5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle Inspection of 4" Tower Saddle Tie Rods, On-Site  
Testing 5-19-10

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b>		ASTM -F788	
<b>Procedure:</b>		SOP 42.03	
<b>METHOD</b>			
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet	
<b>PARTICLES</b>			
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K		<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	
		<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration    MI Batch No.	
<b>CURRENT</b>			
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC	
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)	
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)	
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe			
<b>EQUIPMENT</b>			
<input type="checkbox"/> Magnaflux H-720		S/N:    Cal Due Date:	
<input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC   S/N: 9432   Spacing: 4" - 6"   Cal Due Date: 8/11/10			



STATE OF CALIFORNIA

LOT NO:

B208-082-10

B304-028-10

TH 7/2/10

NAME:

SIB 5-20-10

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*Karen Baumliller*

Karen Baumliller  
Customer Services Manager

5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106623 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 4580 180.31" Tower Saddle Tie Rod	ACCEPTABLE
L106641 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 5035 198.23" Tower Saddle Tie Rod	ACCEPTABLE
L106613 Qty 3 A354 BD NTA5 #99882 4" 4Pitch 4310 169.69" Tower Saddle Tie Rod	ACCEPTABLE
L106609 Qty 3 A354 BD NTA6 #99882 4" 4Pitch 4175 164.37" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/19/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

**EXPORT CONTROLLED (ITAR)**

THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL AFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR OTHER APPROVAL OF THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.

LOT NO: B208-082-10

B304-028-10

NAME: SB 5-20-10

TH 7/2/10

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*Karen Baumiller*  
Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DOMESTIC NUT**

53 Freedom Road  
 Painesville, OH 44077

440-946-3500  
 440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106628	660110-SA-017 C/O 019	87 of 111	2 sets	5/19/10

**CUSTOMER**  
 American Bridge / Fluor JV  
 375 Burma Road  
 Oakland, CA 94607  
 USA

**PRODUCT DESCRIPTION**  
 4.00"-4UNC-2A x 4635mm (182.48") lg. TFL tower saddle tie rod  
 (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex  
 drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans  
 Standard Specification 75-1.05 and ASTM-A123 w/ near white metal  
 blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**DRAWING**

**SPECIFICATIONS**  
 ASTM-A354 Grade BD with special provisions  
 10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	2	NTA2	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-025-10  
 TH 7/2/10

**STATE OF CALIFORNIA**  
**STOCK MATERIAL**


From: Dyson To: Monnig

**LOT NO.** B208-079-10

**INSPECTOR'S**  
**NAME** SB **DATE** 5-19-10

Attachments:

Mill Test Report  
 Mechanical Test Report  
 N.D.E. Report

  
 Deborah A. Smith  
 Q.A. Admin. Assistant  
 5/19/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

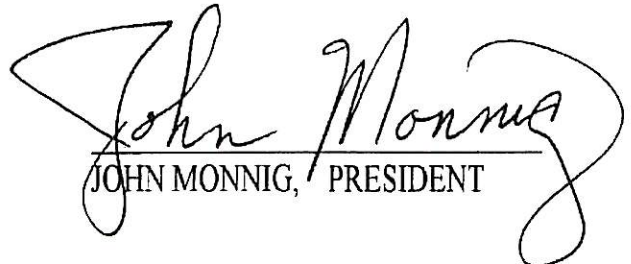
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106628  
2 PC 4" -4UNC-2A X 4635MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS


6	6.5	7	6
6.5	7	5.5	6

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-025-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC





Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106628

2 EA 4" -4UNC-2A x 4635 LG

B304-Q25-10  
TH 7/2/10

  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA2

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.2

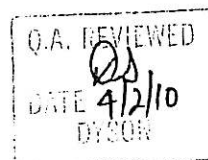
SPEC: Grain Size (Info Only) SIZE F

Heat 99882 SIZE: 7

 STATE OF CALIFORNIA

LOT NO: B208-079-10

NAME: SB S-19-10



B304-025-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_

NOTARY PUBLIC

by

  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA2

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

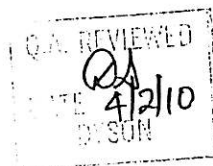
Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-079-10

NAME: SB 5-19-10

B304-025-10

TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

# TEST REPORT

REPORT NO: 147664

DATE: MARCH 11, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA2

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6129 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67037
SPEC: QUENCH, TEMPER, STRAIGHTEN		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	128.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	41.0	
SURF HB	HBW	293 363	323 316	

## TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secn		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 09:47

\*Not Included in our scope of accreditation

Ken Rueff  
Test Center Supervisor

FC 4.12.16F 10/12/09



STATE OF CALIFORNIA

LOT NO: B208-079-10

NAME: SB S-19-10

B304-025-10

TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center



5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106599 Qty 2 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA3 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA6 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106628 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4635 182.48" Tower Saddle Tie Rod	ACCEPTABLE
L106633 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4755 187.2" Tower Saddle Tie Rod	ACCEPTABLE
L106646 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 5185 204.13" Tower Saddle Tie Rod	ACCEPTABLE
L106618 Qty 3 A354 BD NTA4 #99882 4" 4Pitch 4475 176.18" Tower Saddle Tie Rod	ACCEPTABLE
L106637 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 4860 191.34" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/17/10 + 5/18/10 <i>ML</i>	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: <i>Matthew Novak</i> Matthew Novak	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

EXPORT CONTROLLED (ITAR)  
THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.



STATE OF CALIFORNIA

LOT NO: B208-079-10

B304-025-10  
TH 7/2/10

NAME: SB 5-19-10

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle exam on Tower Saddle Tie Rods, Performed On-Site w/Caltran Witness.

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b> ASTM -F788	
<b>Procedure:</b> SOP 42.03	
<b>METHOD</b>	
<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Wet
<b>PARTICLES</b>	
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K	<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other
<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration MI Batch No.	
<b>CURRENT</b>	
<input type="checkbox"/> AC	<input type="checkbox"/> FWDC
<input type="checkbox"/> Central Conductor (AMPS)	<input type="checkbox"/> Head Shot (AMPS)
<input type="checkbox"/> Coil (AMPS)	<input type="checkbox"/> Prods (AMPS/Spacing)
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe	
<b>EQUIPMENT</b>	
<input type="checkbox"/> Magnaflux H-720 S/N: 81471 Cal Due Date: <input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC S/N: 9432 Spacing: 4" - 6" Cal Due Date: 8/11/10	



STATE OF CALIFORNIA

LOT NO: B208-079-10  
NAME: SB 5-19-10

B304-025-10  
TH 7/2/10

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*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DOMESTIC NUT**

53 Freedom Road  
 Painesville, OH 44077

440-946-3500  
 440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106633	660110-SA-017 C/O 019	91 of 111	2 sets	5/19/10

CUSTOMER  
 American Bridge / Fluor JV  
 375 Burma Road  
 Oakland, CA 94607  
 USA

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 4755mm (187.21") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
 10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

**DRAWING**

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	2	NTA2	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-024-10  
 TH 7/2/10

**STATE OF CALIFORNIA  
 STOCK MATERIAL**


From: Dyson TO: Monnig  
 LOT NO. B208-078-10

**INSPECTOR'S**

NAME SB DATE 5-19-10

Attachments:

Mill Test Report  
 Mechanical Test Report  
 N.D.E. Report

  
 Deborah A. Smith

Q.A. Admin. Assistant

5/19/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

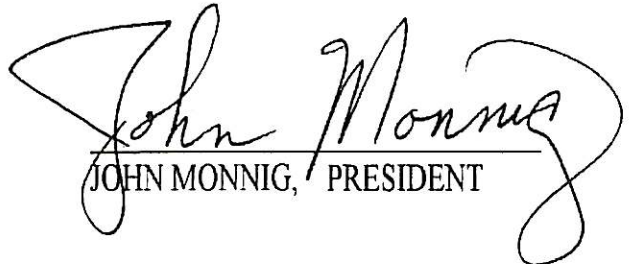
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106633  
2 PC 4" -4UNC-2A X 4755MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

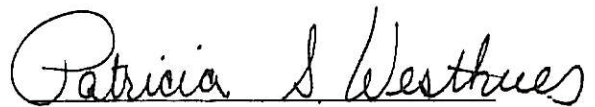
7	6.5	7.5	6.5
6.5	7	7	6.5

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-024-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC





Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

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Dyson Corp ORDER # L106633

2 EA 4" -4UNC-2A x 4755MM LG.

B304-024-10  
TH 7/2/10

KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA2

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

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**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

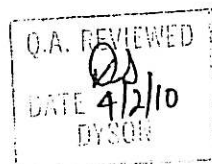
SPEC: Grain Size (Info Only) SIZE F

Heat 99882 SIZE: 7

 STATE OF CALIFORNIA

LOT NO: B208-078-10

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B304-024-10  
TH 7/2/10

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Approved: \_\_\_\_\_

NOTARY PUBLIC

by

Susan Bender  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTAZ

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCBS**

REDUCTION RATIO 12.9:1

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STATE OF CALIFORNIA

LOT NO: B208-078-10

NAME: SB 5-19-10

B304-024-10

TH 7/2/10

THE TIMKEN CORPORATION



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

## TEST REPORT

REPORT NO: 147664

DATE: MARCH 11, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA2

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6129 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67037
SPEC: QUENCH, TEMPER, STRAIGHTEN		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	128.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	41.0	
SURF HB	HBW	293 363	323 316	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell		Micro Analysis*
Tensile, Full Secn		Brinell	TC	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*		Chemistry*
Microhardness, Knoop*				
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services		
Cert #1281-01	Cert #L1157-1	Cert #0510		
2/28/11	2-4-2011	12/31/10		

TIME 09:47

\*Not included in our scope of accreditation

Ken Rueff

Test Center Supervisor



STATE OF CALIFORNIA

FC 4.12.16F 10/12/09

LOT NO: B208-078-10

NAME: SB 5-19-10

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No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

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# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DTN DOMESTIC NUT**

53 Freedom Road  
 Painesville, OH 44077

440-946-3500  
 440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106637	660110-SA-017 C/O 019	95 of 111	1 set	5/19/10

**CUSTOMER**  
 American Bridge / Fluor JV  
 375 Burma Road  
 Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 4860mm (191.34") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
 10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	1	NTA5	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-023-10  
 TH 7/2/10

**STATE OF CALIFORNIA  
 STOCK MATERIAL**

From: Dyson TO: Monnig

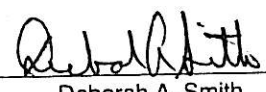
**LOT NO.** B208-077-10

**INSPECTOR'S**

**NAME** SB **DATE** 5-19-10

Attachments:

Mill Test Report  
 Mechanical Test Report  
 N.D.E. Report



Deborah A. Smith  
 Q.A. Admin. Assistant

5/19/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

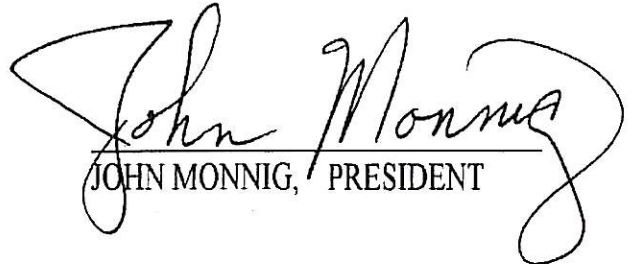
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106637  
1 PC 4" -4UNC-2A X 4860MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

5.5	6.5	6	6.5
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PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

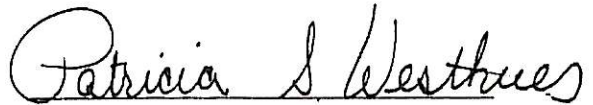
  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

## INSPECTION RELEASE TAG

TL-0624 (REV. 10/03)

STATE LOT NO. B304-023-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY JH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106637

1 EA 4" -4UNC-2A X 4860MM LG

B304-023-10  
TH 7/2/10

  
\_\_\_\_\_  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA5

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

SPEC: Grain Size (Info Only) SIZE F

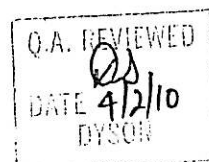
Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-077-10

NAME: SB 5-19-10



B304-023-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved:

NOTARY PUBLIC

by

Susan Bender  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION



Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTAS

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

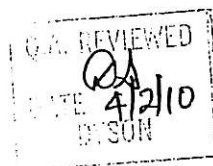
Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-077-10

NAME: SB 5-19-10

B304-023-10  
TH 7/2/10



**TC Industries Test Center**  
 3703 South Route 31  
 Crystal Lake, IL 60012-1412  
 Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

**TEST REPORT**  
**REPORT NO: 147670**  
 DATE: MARCH 17, 2010  
 PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
 105 PINE STREET  
 IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
 105 PINE STREET  
 IMPERIAL, PA 15126-1142

CODE NTA5

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6150 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67122
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	130.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	42.0	
SURF HB	HBW	293 363	327 329	

**TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)**

Tensile, Standard	TC	Rockwell		Micro Analysis*
Tensile, Full Secq		Brinell	TC	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*		Chemistry*
Microhardness, Knoop*				
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services		
Cert #1281-01	Cert #L1157-1	Cert #0510		
2/28/11	2-4-2011	12/31/10		

TIME 08:17

\*Not included in our scope of accreditation

Phil Burgdorf  
 Test Center Tech II

FC 4.12.16F 10/12/09



STATE OF CALIFORNIA

LOT NO: B208-077-10

NAME: SB 5-19-10

B304-023-10  
 TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center.

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106599 Qty 2 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA3 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA6 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106628 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4635 182.48" Tower Saddle Tie Rod	ACCEPTABLE
L106633 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4755 187.2" Tower Saddle Tie Rod	ACCEPTABLE
L106646 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 5185 204.13" Tower Saddle Tie Rod	ACCEPTABLE
L106618 Qty 3 A354 BD NTA4 #99882 4" 4Pitch 4475 176.18" Tower Saddle Tie Rod	ACCEPTABLE
L106637 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 4860 191.34" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RFI-001741R01 & CCO 91 Report for 5/17/10 + 5/18/10 <i>MA</i>	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: <i>Matthew Novak</i> Matthew Novak	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

EXPORT CONTROLLED (ITAR)  
THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.



STATE OF CALIFORNIA

LOT NO: B208-077-10

NAME: SB 5-19-10

*B304-023-10*  
*TH 7/2/10*

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or international test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle exam on Tower Saddle Tie Rods, Performed On-Site w/Caltran Witness.

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b> ASTM -F788	
<b>Procedure:</b> SOP 42.03	
<b>METHOD</b>	
<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Wet
<b>PARTICLES</b>	
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K	<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other
<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration MI Batch No.	
<b>CURRENT</b>	
<input type="checkbox"/> AC	<input type="checkbox"/> FWDC
<input type="checkbox"/> Central Conductor (AMPS)	<input type="checkbox"/> Head Shot (AMPS)
<input type="checkbox"/> Coil (AMPS)	<input type="checkbox"/> Prods (AMPS/Spacing)
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe	
<b>EQUIPMENT</b>	
<input type="checkbox"/> Magnaflux H-720	S/N: 81471 Cal Due Date:
<input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC S/N: 9432 Spacing: 4" - 6" Cal Due Date: 8/11/10	



STATE OF CALIFORNIA

LOT NO: B208-077-10

NAME: SB 5-19-10

B 304-023-10  
TH 7/2/10

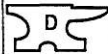
The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 6/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager



# CERTIFIED MATERIAL TEST REPORT



**DYSON CORP.**

**DTN DOMESTIC NUT**

**53 Freedom Road  
Painesville, OH 44077**

**440-946-3500  
440-352-2700 fax**

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106641	660110-SA-017 C/O 019	99 of 111	1 set	5/20/10

**CUSTOMER**

American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607  
USA

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 5035mm (198.23") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

**DRAWING**

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	1	NTA4	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

**STATE OF CALIFORNIA  
STOCK MATERIAL**

*From: Dyson TO: Monnig*

**LOT NO.** B208-083-10

**INSPECTOR'S**

**NAME** SB **DATE** 5-20-10

*B304-029-10  
TH 7/2/10*

Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

Deborah A. Smith  
Q.A. Admin. Assistant

5/20/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

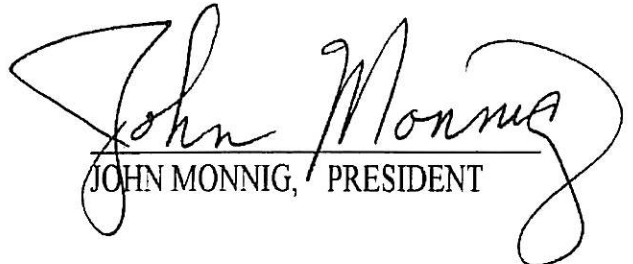
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106641  
1PC 4" -4UNC-2A X 5035MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

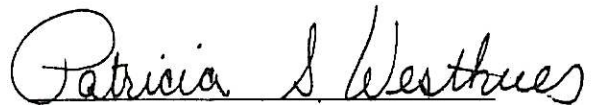
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PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-029-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554  
\* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106641

1 EA 4" -4UNC-2A X 5035MM LG

B304-029-10

TH 7/2/10

KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA4

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

SPEC: Grain Size (Info Only) SIZE FINE

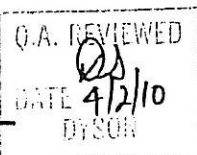
Heat 99882 SIZE: 7



STATE OF CALIFORNIA

LOT NO: B208-083-10

NAME: SB 5-20-10



B304-029-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_ by Susan Bender  
NOTARY PUBLIC Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION



Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTAA

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

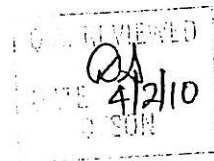
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-083-10

NAME: SB 5-20-10



B304-029-10  
TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

# TEST REPORT

REPORT NO: 147671

DATE: MARCH 15, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTAA

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6137 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67121
SPEC: QUENCH, TEMPER, STRAIGHTEN	ASTM-A354-BD-07A			
AIM-33/37 RC @ SURFACE				
PROCESS:	FURN TEMP: 1800	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	156.0	
YIELD .2%	KSI	115 N/A	131.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	44.0	
SURF HB	HBW	293 363	341 335	

## TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secn		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 10:50

\*Not included in our scope of accreditation



STATE OF CALIFORNIA

*Ken Rueff*

Ken Rueff  
Test Center Supervisor

FC 4.12.16F 10/12/09

LOT NO: B208-083-10

NAME: SB 5-20-10

B304-029-10

TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center

5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle Inspection of 4" Tower Saddle Tie Rods, On-Site  
Testing 5-19-10

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b>	ASTM -F788	
<b>Procedure:</b>	SOP 42.03	
<b>METHOD</b>		
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet
<b>PARTICLES</b>		
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K	<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration    MI Batch No.
<b>CURRENT</b>		
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe		
<b>EQUIPMENT</b>		
<input type="checkbox"/> Magnaflux H-720    S/N:    Cal Due Date:		
<input checked="" type="checkbox"/> Yoke <input type="checkbox"/> AC <input checked="" type="checkbox"/> DC    S/N: 9432    Spacing: 4" - 6"    Cal Due Date: 8/11/10		



STATE OF CALIFORNIA

13208-083-10

B304-029-10  
TH 7/2/10

LOT NO:

SB 5-20-10

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Herron Testing Laboratories' Quality Assurance Program Edition 1, Revision 3 dated 8/30/09. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Stork-Herron Testing Laboratories facilities.

*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

5/20/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-4

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450

Fax : (216) 524-1459

Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106623 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 4580 180.31" Tower Saddle Tie Rod	ACCEPTABLE
L106641 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 5035 198.23" Tower Saddle Tie Rod	ACCEPTABLE
L106613 Qty 3 A354 BD NTA5 #99882 4" 4Pitch 4310 169.69" Tower Saddle Tie Rod	ACCEPTABLE
L106609 Qty 3 A354 BD NTA6 #99882 4" 4Pitch 4175 164.37" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906, ABF-RFI-001741R01 & CCO 91 Report for 5/19/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

**EXPORT CONTROLLED (ITAR)**

THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRADE ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. THE USE OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR OTHER APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.

LOT NO: B208-083-10

NAME: SB 5-20-10

*B304-029-10*  
*TH 7/2/10*

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*Karen Baumann*  
Karen Baumann  
Customer Services Manager



# CERTIFIED MATERIAL TEST REPORT

**DYSON CORP.**  
**DTN DOMESTIC NUT**

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106646	660110-SA-017 C/O 019	103 of 111	1 set	5/19/10

**CUSTOMER**  
American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 5185mm (204.13") lg. TFL tower saddle tie rod (assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans Standard Specification 75-1.05 and ASTM-A123 w/ near white metal blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	1	NTA2	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-022-10  
TH 7/2/10

**STATE OF CALIFORNIA  
STOCK MATERIAL**

From: Dyson TO: Monnig

LOT NO. B208-076-10

**INSPECTOR'S**

NAME SB DATE 5-19-10

Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report



Deborah A. Smith  
Q.A. Admin. Assistant  
5/19/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

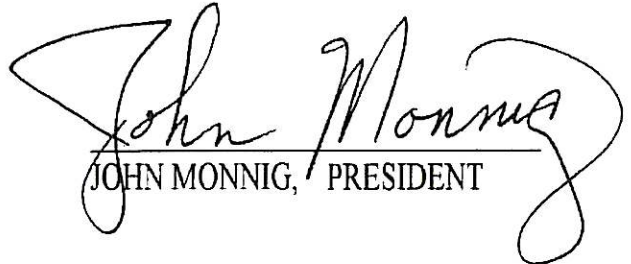
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106646  
1 PC 4" -4UNC-2A X 5185MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

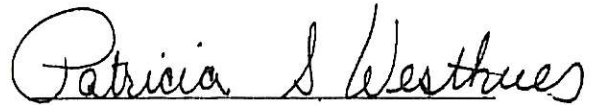
6.5	7	6	7.5
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PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)

STATE LOT NO. B304-022-10  
CONTRACT NO. 04-0120F4  
RELEASED (\*) BY TH DATE 7/2/10  
FM 92 1554 \* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106646

1 EA 4" -4UNC-2A x 5185MM LG

B304-022-10  
TH 7/2/10

  
KIRBY NORRIS

Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA2

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

Heat 99882 DI ASTM-A255: 6.25

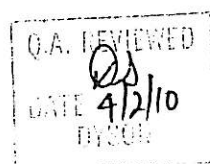
SPEC: Grain Size (Info Only) SIZE FIN

Heat 99882 SIZE: 7

 STATE OF CALIFORNIA

LOT NO: B208-076-10

NAME: SB 5-19-10



B304-022-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved:

NOTARY PUBLIC

by

  
Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION



Jan. 5, 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTA2

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

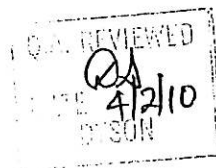
Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



LOT NO: B208-076-10

NAME: SB 5-19-10

B304-022-10

TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



## TEST REPORT

REPORT NO: 147664

DATE: MARCH 11, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA2

DESC: 6 PCS	4"RD X 23'6"	HEAT#: 99882	GRADE: 4140	WT: 6129 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67037
SPEC: QUENCH, TEMPER, STRAIGHTEN		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	154.0	
YIELD .2%	KSI	115 N/A	128.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	41.0	
SURF HB	HBW	293 363	323 316	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell	Micro Analysis*
Tensile, Full Secn		Brinell	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*	Chemistry*
Microhardness, Knoop*			
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services	
Cert #1281-01	Cert #L1157-1	Cert #0510	
2/28/11	2-4-2011	12/31/10	

TIME 09:47

\*Not included in our scope of accreditation



STATE OF CALIFORNIA

*Ken Rueff*

Ken Rueff  
Test Center Supervisor

FC 4.12.16F 10/12/09

LOT NO: B208-076-10

NAME: SB 5-19-10

B304-022-10

TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center

5/19/2010

Material Testing and Non-Destructive Testing

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Date Received: 5/14/2010

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

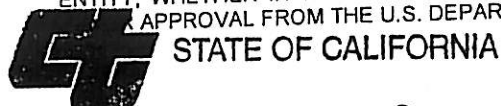
Test Report No.: DYS006-10-05-02091-1

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106599 Qty 2 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA3 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA4 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106656 Qty 1 A354 BD NTA6 #99882 4" 4Pitch 1840 72.44" Tower Saddle Tie Rod	ACCEPTABLE
L106628 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4635 182.48" Tower Saddle Tie Rod	ACCEPTABLE
L106633 Qty 2 A354 BD NTA2 #99882 4" 4Pitch 4755 187.2" Tower Saddle Tie Rod	ACCEPTABLE
L106646 Qty 1 A354 BD NTA2 #99882 4" 4Pitch 5185 204.13" Tower Saddle Tie Rod	ACCEPTABLE
L106618 Qty 3 A354 BD NTA4 #99882 4" 4Pitch 4475 176.18" Tower Saddle Tie Rod	ACCEPTABLE
L106637 Qty 1 A354 BD NTA5 #99882 4" 4Pitch 4860 191.34" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906,ABF-RF1-001741R01 & CCO 91 Report for 5/17/10 + 5/18/10 <i>21.1</i>	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

EXPORT CONTROLLED (ITAR)  
THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF  
THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS  
OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN  
ENTITY, WHETHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR  
APPROVAL FROM THE U.S. DEPARTMENT OF STATE, IS PROHIBITED.



LOT NO: B208-076-10  
NAME: SB 5-19-10

*B304-022-10*  
*TH 7/2/10*

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*Karen Baumiller*

Karen Baumiller  
Customer Services Manager

NAME: SIS S-14-10

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Karen Baumiller  
Customer Services Manager



# CERTIFIED MATERIAL TEST REPORT



DYSON CORP.

DTN DOMESTIC NUT

53 Freedom Road  
Painesville, OH 44077

440-946-3500  
440-352-2700 fax

DYSON ORDER#	CUSTOMER ORDER#	ITEM NUMBER	QUANTITY SHIPPED	DATE SHIPPED
L 106651	660110-SA-017 C/O 019	107 of 111	2 sets	5/21/10

**CUSTOMER**

American Bridge / Fluor JV  
375 Burma Road  
Oakland, CA 94607

USA

**DRAWING**

**PRODUCT DESCRIPTION**

4.00"-4UNC-2A x 5325mm (209.65") lg. TFL tower saddle tie rod  
(assembly incl. 4 hex full nuts, 4 hex jam nut & 4 washers) w/ hex  
drive on both ends per Dwg. JSW-TS-017. HDG per Caltrans  
Standard Specification 75-1.05 and ASTM-A123 w/near white metal  
blast prior to galvanizing. Tower Saddle Tie Rod Assembly - Group

**SPECIFICATIONS**

ASTM-A354 Grade BD with special provisions  
10-1.59, 10-1.60, 10-1.61 std specifications 75-1.05

STARTING MATERIAL	DIA	GRADE	QTY	LOT CODE	HEAT NO.	ORIGINAL MILL
Round Bar	3.830	BD	2	NTA6	99882	Timken

The product listed above was manufactured, tested, sampled, and inspected in accordance with the specification, purchase order, and any supplementary requirements and was found to meet those requirements unless otherwise noted.

B304-032-10  
TH 7/2/10

**STATE OF CALIFORNIA  
STOCK MATERIAL**

From: Dyson TO: Mannig

LOT NO. B208-DB6-10

**INSPECTOR'S**

NAME SB DATE 5-21-10

Attachments:

Mill Test Report  
Mechanical Test Report  
N.D.E. Report

Deborah A. Smith  
Q.A. Admin. Assistant

5/21/10

# Monnig Industries, Inc.

HOT DIP & MECHANICAL GALVANIZING

P.O. BOX 98

GLASGOW, MO 65254

PH. 660-338-2242 FAX: 660-338-5199

JULY 2, 2010

DYSON CORPORATION  
50 FREEDOM ROAD  
PAINESVILLE, OH 44077

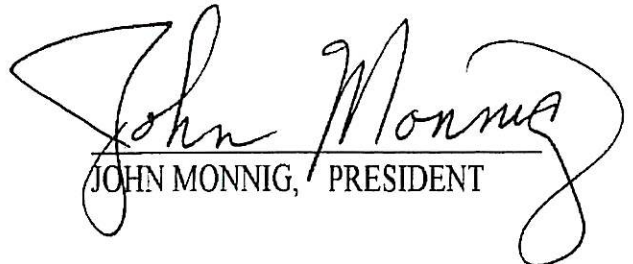
RE: GALVANIZING CERTIFICATE-CALTRAN  
ORDER# L 106651  
2PCS 4" -4UNC-2A X 5325MM LG.  
TFL TOWER SADDLE TIE ROD

THIS WILL CERTIFY THAT THE MATERIAL GALVANIZED ON THE ABOVE  
JOB MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS OF ASTM A-153  
SPECIFICATIONS. THE MATERIAL IS ALSO CERTIFIED MERCURY FREE.

## MILL READINGS

7	6.5	7	7.5
6.5	6.5	7	6.5
7	6.5	6.5	6.5

PATRICIA S. WESTHUES  
NOTARY PUBLIC STATE OF MISSOURI  
HOWARD COUNTY  
MY COMMISSION EXP. APR. 18, 2012

  
JOHN MONNIG, PRESIDENT

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION  
**INSPECTION RELEASE TAG**  
TL-0624 (REV. 10/03)


STATE LOT NO. B304-032-10

CONTRACT NO. 04-0120F4

RELEASED (\*) BY T.H. DATE 7/2/10

FM 92 1554

\* Based upon selective sampling

  
PATRICIA S. WESTHUES,  
NOTARY PUBLIC



Phoenix Manufacturing, Inc.  
P.O. BOX 330  
26666 Von Holten Rd.  
Cole Camp, MO. 65325  
660-668-2611  
660-668-3160 (fax)

SSPC-SP10 Near White Metal Blast

**Near-White Blast Cleaning** - Removal of nearly all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels, to the degree hereafter specified. A Near-White Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or light, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

Dyson Corp Order # L 106651

2 EA 4" -4UNC-2A X 5325MM LG.

B304-032-10  
TH 7/2/10

KIRBY NORRIS

Jan. 5, 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706  
ID #0234930-1

Page 1 of 2

No. 0852 P. 3  
**TIMKEN**  
Where You Turn  
01/05/2010

S Turret Steel Industries, Inc.  
O T 3900 W. 74th Street  
L O  
D CHICAGO IL 60629-4354 USA

CODE NTA6

S LATER  
H T LATER  
I O LATER  
P DOMESTIC

Customer Order: 28599-2 Customer Part Number:  
Timken Order: 15743-A (1615680) Heat Number(s): 99882

**Description of Material**

DIAMETER: 4.000 in (101.600 mm)  
Shape: RD  
Sales Type: 4140H  
Int Quality: ELECTRIC FURNACE-VACUUM DEGAS  
Condition: HOT ROLL

**Specification**

- ASTM A 304 Rev. 05e2
- ASTM A 322 Rev. 07
- ASTM E 381 Rev. 01 (Reapproved 2006)
- TURRET STEEL TSI-130 4/13/2007 EXCEPT AS NOTED- EXCEPT MACROETCH, HARDNESS, JOMINY ENGLISH CAST

**Chemistry Information**

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V	%Cb
SPEC Ladle Min:	.37	.65			.15	.75		.15				
SPEC Ladle Max:	.44	1.10	.025	.025	.35	1.20		.25				
99882 Ladle:	.41	.99	.009	.020	.32	1.05	.15	.16	.18	.024	.007	.002

**Metallurgy Information**

SPEC: Chemistry (Info Only)

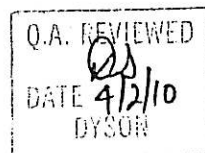
Heat 99882 DI ASTM-A255: 6.2

SPEC: Grain Size (Info Only) SIZE F

Heat 99882 SIZE: 7

LOT NO: B208-086-10

NAME: SB 5-21-10



B304-032-10  
TH 7/2/10

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: \_\_\_\_\_ by Susan Bender  
NOTARY PUBLIC Susan Bender, SUPERVISOR-PROD MET LAB

THE TIMKEN CORPORATION



Jan. 5. 2010 12:13PM MET LAB  
**Steel Certificate of Test**

1835 DUEBER AVE. S.W.  
CANTON, OHIO 44706

CODE NTAG

No. 0852 P. 4  
**TIMKEN**  
Where You Turn

ID #0234930-1

Page 2 of 2

01/05/2010

Customer Order: 20599-2

Customer Part Number:

Timken Order: 15743-A (1615680)

Heat Number(s): 99882

**Metallurgy Information (cont.)**

SPEC: Jominy English SAMPLE TYPE CAST 4140H

Location:	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32	36	40
SPEC Min:	53	53	52	51	51	50	48	47	44	42	39	37	35	34	33	32	31	30		
SPEC Max:	60	60	60	59	59	58	58	57	57	56	55	54	53	52	51	48	46	44		
99882 A1-01:	58	57	57	56	55	55	54	54	53	51	49	46	44	42	42	40	39	38	38	37

Heat 99882 Melt Source: USA  
Manufacturing: USA

**STRAND CAST PROCESS**

REDUCTION RATIO 12.9:1

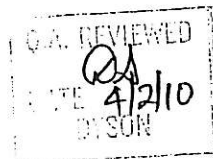
The Timken Company certifies that there is no mercury or radio-active material used in the melting or processing.



STATE OF CALIFORNIA

LOT NO: B208-086-10

NAME: SB 5-21-10



B304-032-10  
TH 7/2/10



**TC Industries Test Center**  
3703 South Route 31  
Crystal Lake, IL 60012-1412  
Telephone 815/459/2400 Fax 815/459/3419



Certificate No. 1281-01

## TEST REPORT

REPORT NO: 147668

DATE: MARCH 15, 2010

PAGE 1 OF 1

TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

SHIP TO: TURRET STEEL INDUSTRIES  
105 PINE STREET  
IMPERIAL, PA 15126-1142

CODE NTA6

DESC: 6 PCS	4"RD X 23"6"	HEAT#: 99882	GRADE: 4140	WT: 6139 #
	PO: 29132	MO: N/A	CO: 29132	LOT: 67123
SPEC: QUENCH, TEMPER, STRAIGHTEN AIM-33/37 RC @ SURFACE		ASTM-A354-BD-07A		
PROCESS:	FURN TEMP: 1600	FURN TIME hh:mm: 2.40	QUENCH: OIL	
	TEMPER TEMP: 950	TEMPER TIME hh:mm: 4.00		
	STRESS TEMP:	STRESS TIME hh:mm:		
PARAMETER	UNITS	LIMITS	TEST RESULTS (See sampling plan on back)	
TENSILE	KSI	140 N/A	168.0	
YIELD .2%	KSI	115 N/A	132.0	
ELONG 2"	%	14 N/A	15.0	
RED AREA	%	40 N/A	45.0	
SURF HB	HBW	293 363	306 310	

### TC INDUSTRIES AND SUBCONTRACTED LABS (A2LA ACCREDITED)

Tensile, Standard	TC	Rockwell		Micro Analysis*
Tensile, Full Secn		Brinell	TC	Decarb Measure
Charpy V 10mmx10mm		Ultra Sonic*		Chemistry*
Microhardness, Knoop*				
TC: TC Ind Test Center	BE: Berg Engineering	MSI: Metallurgical Services		
Cert #1281-01	Cert #L1157-1	Cert #0510		
2/28/11	2-4-2011	12/31/10		

TIME 10:49

\*Not included in our scope of accreditation

Ken Rueff

Test Center Supervisor



STATE OF CALIFORNIA

FC 4.12.16F 10/12/09

LOT NO: B208-086-10

NAME: SB 5-21-10

B304-032-10  
TH 7/2/10

There are no deviations from test methods unless noted. It should not be assumed that mechanical properties of raw material heat treated to a fastener standard will have the same properties of a finished fastener whose original material characteristics may have been significantly altered.

No mercury was used/added and no welding/weld repair was performed on this material while in the possession of TC Industries, Inc.

This original test report displays a raised "TC Industries Test Center" seal. This test report relates only to the items tested and shall not be reproduced, except in full, without the written permission of TC Industries Test Center



LOT NO:

B208-086-10

B304-032-10

TH 7/2/10

NAME:

SB 5-21-10

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Karen Baumbler  
Customer Services Manager

5/21/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-3

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA


Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

Sample Description: Magnetic Particle Inspection of Tower Saddle Tie Rods  
On-Site Testing 5-20-10

**MAGNETIC PARTICLE INSPECTION REPORT**

<b>Standard:</b>	ASTM -F788		
<b>Procedure:</b>	SOP 42.03		
<b>METHOD</b>			
<input type="checkbox"/> Dry		<input checked="" type="checkbox"/> Wet	
<b>PARTICLES</b>			
<b>Magnaflux Particles:</b> <input type="checkbox"/> 8A Red <input type="checkbox"/> 14A <input type="checkbox"/> 3A Black <input checked="" type="checkbox"/> 14AM <input type="checkbox"/> 1 Gray <input type="checkbox"/> Other Batch No. 07E06K		<b>Part Preparation:</b> <input type="checkbox"/> None Required <input type="checkbox"/> Solvent Clean <input type="checkbox"/> Grinding <input type="checkbox"/> Other	
		<b>Wet Particle Carrier:</b> <input type="checkbox"/> Magnaflux Carrier II <input checked="" type="checkbox"/> Pre Mixed <input type="checkbox"/> Concentration      MI Batch No.	
<b>CURRENT</b>			
<input type="checkbox"/> AC		<input type="checkbox"/> FWDC	
<input type="checkbox"/> Central Conductor (AMPS)		<input type="checkbox"/> Head Shot (AMPS)	
<input type="checkbox"/> Coil (AMPS)		<input type="checkbox"/> Prods (AMPS/Spacing)	
Field Verified by: <input checked="" type="checkbox"/> Pie Gage <input type="checkbox"/> QQI <input type="checkbox"/> Hall Effect Probe			
<b>EQUIPMENT</b>			
<input type="checkbox"/> Magnaflux H-720		S/N:      Cal Due Date:	
 <input checked="" type="checkbox"/> AC <input checked="" type="checkbox"/> DC		S/N: 9432      Spacing: 4" - 6"      Cal Due Date: 8/11/10	

LOT NO: B208-086-10

B304-032-10  
TH 7/2/10

NAME: SB 5-21-10

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Karen Baumiller  
Customer Services Manager



5/21/2010

Steve Marsh  
Dyson Corp.  
53 Freedom Road  
PAINESVILLE, OH 44077-1232

Date Received: 5/19/2010

Test Report No.: DYS006-10-05-02316-3

Material Testing and Non-Destructive  
Testing

5405 E. Schaaf Road  
Cleveland, OH 44131  
USA

Telephone : (216) 524-1450  
Fax : (216) 524-1459  
Website : www.storkherron.com

**TEST REPORT**

P.O. No.: 72218

INSPECTION RESULTS	
	Results
L106605 Qty 5 A354 BD NTA3 #99882 4" 4Pitch 4090 161.02" Tower Saddle Tie Rod	ACCEPTABLE
L106651 Qty 2 A354 BD NTA6 #99882 4" 4Pitch 5325 209.65" Tower Saddle Tie Rod	ACCEPTABLE
Comments: State Letter-05.03.01-002906, ABF-RFI-001741R01 & CCO 91 Report for 5/20/10	
Marking Requirements:	
Demag and post cleaning requirements:	
Inspected by: Matthew Novak <i>Matthew Novak</i>	Certification: ASNT-SNT-TC-1A Level <input type="checkbox"/> II <input checked="" type="checkbox"/> III

EXPORT CONTROLLED (ITAR)

THE TECHNICAL DATA AND / OR MATERIALS ASSOCIATED WITH THIS ORDER FALLS WITHIN THE DEFINITION OF THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR) AND IS SUBJECT TO THE EXPORT CONTROL LAWS OF THE U.S. GOVERNMENT. TRANSFER OF THIS DATA BY ANY MEANS TO A FOREIGN PERSON OR FOREIGN ENTITY, EITHER IN THE UNITED STATES OR ABROAD, WITHOUT AN EXPORT LICENSE, ITAR EXEMPTION OR OTHER AUTHORITY OF STATE, IS PROHIBITED.

LOT NO: B208-086-10

NAME: SB 5-21-10

B304-032-10  
TH 7/2/10

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*Karen Baumbler*

Karen Baumbler  
Customer Services Manager



# Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products<sup>1</sup>

This standard is issued under the fixed designation A123/A123M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope\*

1.1 This specification covers the requirements for zinc coating (galvanizing) by the hot-dip process on iron and steel products made from rolled pressed and forged shapes, castings, plates, bars, and strips.

1.2 This specification covers both unfabricated products and fabricated products, for example, assembled steel products, structural steel fabrications, large tubes already bent or welded before galvanizing, and wire work fabricated from uncoated steel wire. This specification also covers steel forgings and iron castings incorporated into pieces fabricated before galvanizing or which are too large to be centrifuged (or otherwise handled to remove excess galvanizing bath metal).

NOTE 1—This specification covers those products previously addressed in Specifications A123-78 and A386-78.

1.3 This specification does not apply to wire, pipe, tube, or steel sheet which is galvanized on specialized or continuous lines, or to steel less than 22 gage (0.0299 in.) [0.76 mm] thick.

1.4 The galvanizing of hardware items that are to be centrifuged or otherwise handled to remove excess zinc (such as bolts and similar threaded fasteners, castings and rolled, pressed and forged items) shall be in accordance with Specification **A153/A153M**.

1.5 Fabricated reinforcing steel bar assemblies are covered by the present specification. The galvanizing of separate reinforcing steel bars shall be in accordance with Specification **A767/A767M**.

1.6 This specification is applicable to orders in either inch-pound units (as A123) or SI units (as A123M). Inch-pound units and SI units are not necessarily exact equivalents. Within the text of this specification and where appropriate, SI units are shown in parentheses. Each system shall be used independently of the other without combining values in any way. In the case of orders in SI units, all testing and inspection shall be done using the metric equivalent of the test or

inspection method as appropriate. In the case of orders in SI units, such shall be stated to the galvanizer when the order is placed.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

**A47/A47M** Specification for Ferritic Malleable Iron Castings

**A90/A90M** Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

**A143/A143M** Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

**A153/A153M** Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

**A384/A384M** Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

**A385** Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

**A767/A767M** Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

**A780** Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

**A902** Terminology Relating to Metallic Coated Steel Products

**B6** Specification for Zinc

**B487** Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section

**B602** Test Method for Attribute Sampling of Metallic and Inorganic Coatings

**B960** Specification for Prime Western Grade-Recycled (PWG-R) Zinc

**E376** Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **A05** on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee **A05.13** on Structural Shapes and Hardware Specifications.

Current edition approved May 1, 2012. Published July 2012. Originally approved in 1928. Last previous edition approved in 2009 as A123/A123M - 09. DOI: 10.1520/A0123\_A0123M-12.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard.



### 3. Terminology (See Fig. 1)

#### 3.1 Definitions:

3.1.1 The following terms and definitions are specific to this specification. Terminology A902 contains other terms and definitions relating to metallic-coated steel products.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *average coating thickness,  $n$* —the average of three specimen coating thicknesses.

3.2.2 *black, adj*—denotes the condition of not galvanized or otherwise coated. For purposes of this specification the word

“black” does not refer to the color or condition of surface, or to a surface deposit or contamination.

3.2.3 *coating thickness grade,  $n$* —the numerical value from Table 1 at the intersection of a material category and a thickness range.

3.2.4 *gross cross inclusions,  $n$* —the iron/zinc intermetallics present in a galvanized coating in a form other than finely dispersed pimples.

3.2.4.1 *Discussion*—These inclusions would create an exposed steel spot if they were removed from the coating. These

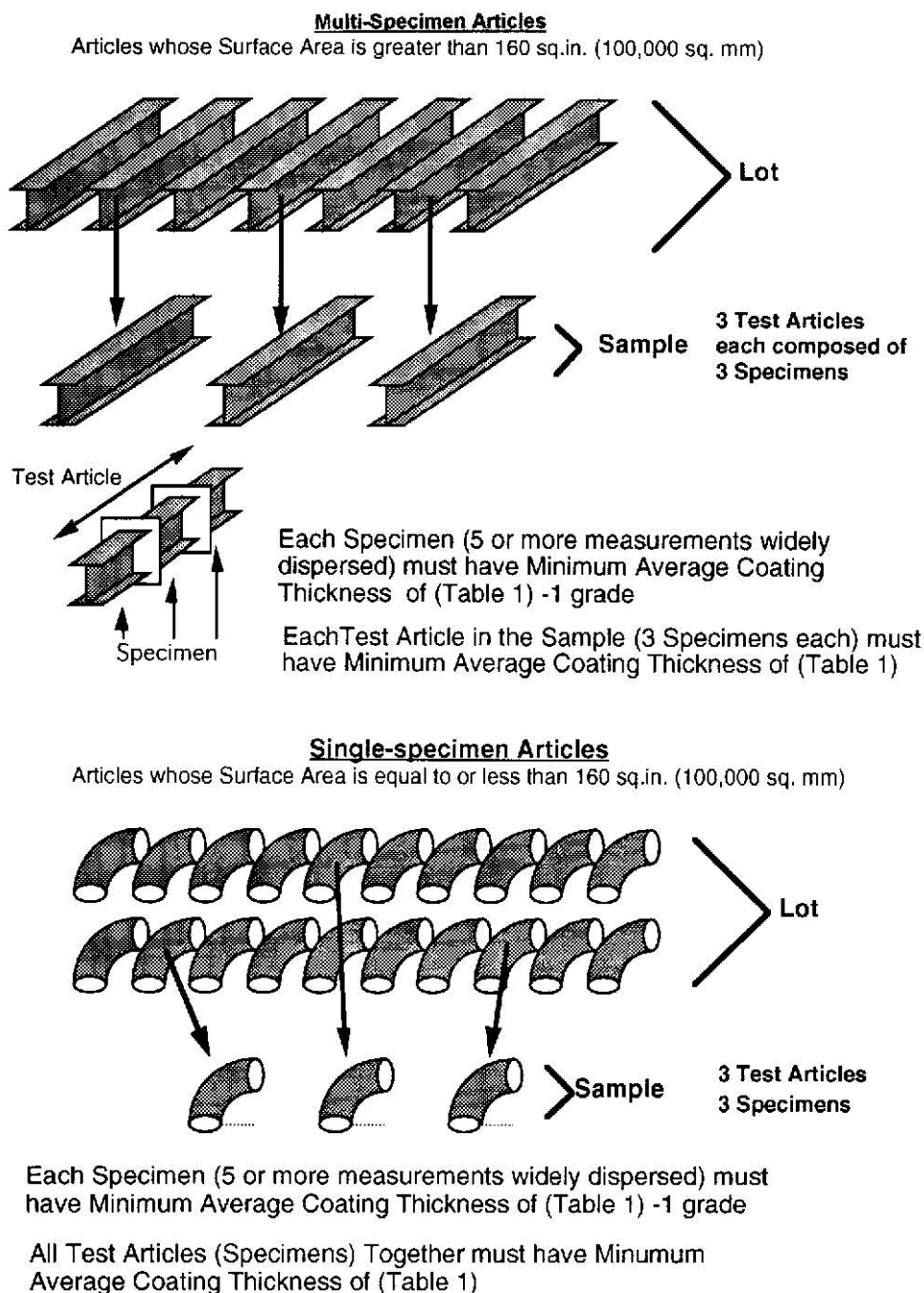




TABLE 1 Minimum Average Coating Thickness Grade by Material Category

Material Category	All Specimens Tested				
	Steel Thickness Range (Measured), in. (mm)				
	$<1/16$ ( $<1.6$ )	$1/16$ to $<1/8$ (1.6 to $<3.2$ )	$1/8$ to $3/16$ (3.2 to 4.8)	$>3/16$ to $<1/4$ ( $>4.8$ to $<6.4$ )	$\geq 1/4$ ( $\geq 6.4$ )
Structural Shapes and Plate	45	65	75	75	100
Strip and Bar	45	65	75	75	100
Pipe and Tubing	45	45	75	75	75
Wire	35	50	60	65	80
Reinforcing Bar	...	...	...	...	100

inclusions are raised surfaces and are easily knocked off through contact with lifting straps or chains, tools, fixtures, or other galvanized parts.

3.2.5 *material category, n*—the general class or type of material or process of manufacture, or both, that nominally describes a unit of product, or from which a unit of product is made. For example, bar grating belongs to the category “strip,” handrail belongs to the category “pipe,” etc.

3.2.6 *multi-specimen article, n*—a unit of product whose surface area is greater than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>]. For thickness testing purposes, articles whose surface area is greater than 160 in.<sup>2</sup> are subdivided into three continuous local sections, nominally equal in surface area, each of which constitutes a specimen. In the case of any such local section containing more than one material category or steel thickness range as delineated in Table 1, that section will contain more than one specimen (see Fig. 1).

3.2.7 *sample, n*—a collection of individual units of product from a single lot selected in accordance with Section 7, and intended to represent that lot for acceptance. If a sample is taken as representing the lot for acceptance, the sample shall be taken at random from the lot without regard to the perceived quality or appearance of any individual unit in the lot being sampled. The sample consists of one or more test articles.

3.2.8 *single-specimen article, n*—a unit of product whose surface area is equal to or less than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>] or that is centrifuged or otherwise similarly handled in the galvanizing process to remove excess galvanizing bath metal (free zinc). For thickness testing purposes, the entire surface area of each unit of product constitutes a specimen. In the case of any such article containing more than one material category or steel thickness range as delineated in Table 1, that article will contain more than one specimen (see Fig. 1).

3.2.9 *specimen, n*—the surface of an individual test article or a portion of a test article, upon which thickness measurements are to be performed, which is a member of a lot, or a member of a sample representing that lot. For magnetic thickness measurements, specimen excludes any area of the surface which is subject to processes (such as flame cutting, machining, threading, etc.) that can be expected to result in surface conditions not representative of the general surface condition of the test article, or is disqualified by the measurement method. The minimum average coating thickness grade for any specimen shall be one coating grade below that required for the appropriate material category and thickness in Table 1. For a unit of product whose surface area is equal to or less than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>], the entire surface area of each test article constitutes a specimen. In the case of an article

containing more than one material category or steel thickness range as delineated in Table 1, that article will contain more than one specimen, as appropriate (see Fig. 1).

3.2.10 *specimen coating thickness, n*—the average thickness from no less than five test measurements on a specimen, when each measurement location is selected to provide the widest dispersion (in all applicable directions) of locations for the steel category of the test article within the confines of the specimen volume.

3.2.11 *test article, n*—an individual unit of product that is a member of the sample and that is examined for conformance to a part of this specification.

#### 4. Ordering Information

4.1 Orders for coatings provided under this specification shall include the following:

4.1.1 Quantity (number of pieces to be galvanized) and total weight.

4.1.2 Description (type and size of products) and weight.

4.1.3 ASTM specification designation and year of issue.

4.1.4 Material identification (see 5.1) and surface condition or contamination.

4.1.5 Sampling plan, if different from 7.3.

4.1.6 Special test requirements (see 8.1).

4.1.7 Special requirements (special stacking, heavier coating weight, etc.).

4.1.8 Tagging or piece identification method.

#### 5. Materials and Manufacture

5.1 *Steel or Iron*—The specification, grade, or designation and type and degree of surface contamination of the iron or steel in articles to be galvanized shall be supplied by the purchaser to the hot-dip galvanizer prior to galvanizing.

NOTE 2—The presence in steels and weld metal, in certain percentages, of some elements such as silicon, carbon, and phosphorus tends to accelerate the growth of the zinc-iron alloy layer so that the coating may have a matte finish with little or no outer zinc layer. The galvanizer has only limited control over this condition. The mass, shape, and amount of cold working of the product being galvanized may also affect this condition. Practice A385 provides guidance on steel selection and discusses the effects of various elements in steel compositions (for example, silicon), that influence coating weight and appearance.

5.2 *Fabrication*—The design and fabrication of the product to be galvanized are the responsibilities of the designer and the fabricator. Practices A143/A143M, A384/A384M, and A385 provide guidance for steel fabrication for optimum hot dip galvanizing and shall be complied with in both design and fabrication. Consultation between the designer, fabricator, and



galvanizer at appropriate stages in the design and fabrication process will reduce future problems.

**5.3 Castings**—The composition and heat treatment of iron and steel castings shall conform to specifications designated by the purchaser. Some types of castings have been known to show potential problems with predisposition to being embrittled during the normal thermal cycle of hot-dip galvanizing. It is the responsibility of the purchaser to heat treat or otherwise allow for the possibility of such embrittling phenomena. The requirements for malleable iron castings to be galvanized shall be as stated in Specification A47/A47M.

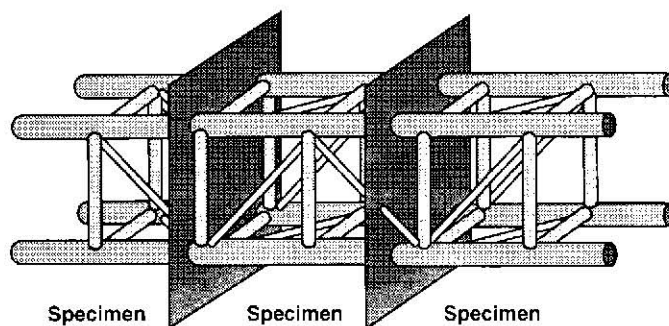
**5.4 Zinc**—The zinc used in the galvanizing bath shall conform to Specification B6, or Specification B960, or both. If a zinc alloy is used as the primary feed to the galvanizing bath, then the base material used to make that alloy shall conform to Specification B6, or Specification B960, or both.

**5.5 Bath Composition**—The molten metal in the working volume of the galvanizing bath shall contain not less than an average value of 98.0 % zinc by weight.

**NOTE 3**—The galvanizer may choose to add trace amounts of certain elements (for example, aluminum, nickel, and tin) to the zinc bath to help in the processing of certain reactive steels or to enhance the cosmetic appearance of the finished product. The use of these trace elements is permitted provided that the bulk chemistry of the galvanizing bath is at least 98.0 % zinc by weight. The elements can be added to the galvanizing bath as part of a pre-alloyed zinc feed, or they can be added to the bath by the galvanizer using a master feed alloy.

## 6. Coating Properties

**6.1 Coating Thickness**—The average thickness of coating for all specimens tested shall conform to the requirements of Table 1 for the categories and thicknesses of the material being galvanized. Minimum average thickness of coating for any individual specimen is one coating grade less than that required in Table 1. Where products consisting of various material thicknesses or categories are galvanized, the coating thickness grades for each thickness range and material category of material shall be as shown in Table 1. In the case of orders in SI units, the values in Table 1, shall be applicable as metric units in micrometres. In the case of orders in inch-pound units, the measured value shall be converted to coating grade units by the use of Table 2. The specification of coating thicknesses heavier than those required by Table 1 shall be subject to mutual agreement between the galvanizer and the purchaser. (Fig. 2 is a graphic representation of the sampling and



**NOTE 1**—Each specimen comprises nominally one third of the total surface area of the article. A minimum of five measurements should be made within the volume of each specimen, as widely dispersed within that volume as is practical, so as to represent as much as possible, the general coating thickness within that specimen volume.

**FIG. 2 Articles Made of Many Components**

specimen delineation steps, and Fig. 3 is a graphic representation of the coating thickness inspection steps.)

**6.1.1** For articles whose surface area is greater than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>] (multi-specimen articles), each test article in the sample must meet the appropriate minimum average coating thickness grade requirements of Table 1, and each specimen coating thickness grade comprising that overall average for each test article shall average not less than one coating grade below that required in Table 1.

**6.1.2** For articles whose surface area is equal to or less than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>] (single-specimen articles), the average of all test articles in the sample must meet the appropriate minimum average coating thickness grade requirements of Table 1, and for each test article, its specimen coating thickness shall be not less than one coating grade below that required in Table 1.

**6.1.3** No individual measurement, or cluster of measurements at the same general location, on a test specimen shall be cause for rejection under the coating thickness requirements of this specification provided that when those measurements are averaged with the other dispersed measurements to determine the specimen coating thickness grade for that specimen, the requirements of 6.1.1 or 6.1.2, as appropriate are met.

**NOTE 4**—The coating thickness grades in Table 1 represent the minimum value obtainable with a high level of confidence for the ranges typically found in each material category. While most coating thicknesses

**TABLE 2 Coating Thickness Grade<sup>A</sup>**

Coating Grade	mils	oz/ft <sup>2</sup>	µm	g/m <sup>2</sup>
35	1.4	0.8	35	245
45	1.8	1.0	45	320
50	2.0	1.2	50	355
55	2.2	1.3	55	390
60	2.4	1.4	60	425
65	2.6	1.5	65	460
75	3.0	1.7	75	530
80	3.1	1.9	80	565
85	3.3	2.0	85	600
100	3.9	2.3	100	705

<sup>A</sup> The values in micrometres (µm) are based on the Coating Grade. The other values are based on conversions using the following formulas: mils = µm × 0.03937; oz/ft<sup>2</sup> = µm × 0.02316; g/m<sup>2</sup> = µm × 7.067.



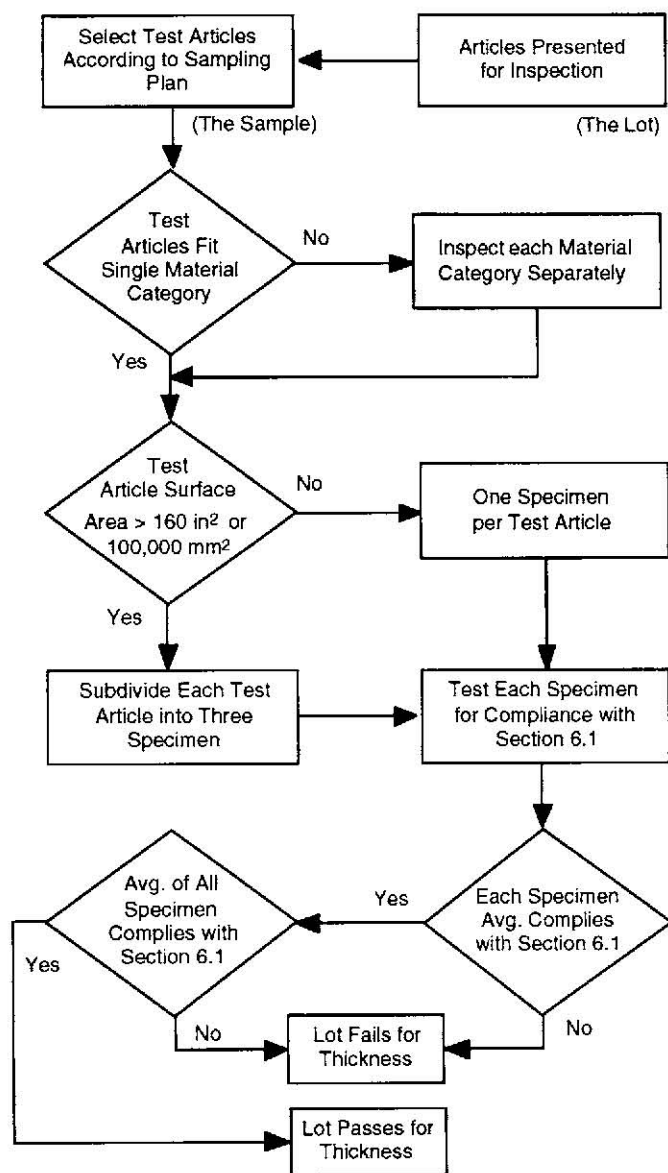


FIG. 3 Coating Thickness Inspection Steps

will be in excess of those values, some materials in each category may be less reactive (for example, because of chemistry or surface condition) than other materials of the steel category spectrum. Therefore, some articles may have a coating grade at or close to the minimum requirement shown in Table 1. In such cases, the precision and accuracy of the coating thickness measuring technique should be taken into consideration when rejecting such articles for coating thickness below that required by this specification. Purchasers desiring a guarantee of heavier coatings than the minimum thicknesses shown herein should use the special requirements (see 4.1.6) to specify coating thickness grades higher than those shown in Table 1. In addition, the purchaser should anticipate the need for test batches or extra preparation steps, or both, such as blasting before galvanizing or other methods, to attempt to reach the higher requirements with consistency. Some higher-than-standard thicknesses may be impractical or unattainable.

**6.2 Finish**—The coating shall be continuous (except as provided below), and as reasonably smooth and uniform in thickness as the weight, size, shape of the item, and necessary handling of the item during the dipping and draining operations

at the galvanizing kettle will permit. Except for local excess coating thickness which would interfere with the use of the product, or make it dangerous to handle (edge tears or spikes), rejection for nonuniform coating shall be made only for plainly visible excess coating not related to design factors such as holes, joints, or special drainage problems (see Note 6). Since surface smoothness is a relative term, minor roughness that does not interfere with the intended use of the product, or roughness that is related to the as-received (un-galvanized) surface condition, steel chemistry, or steel reactivity to zinc shall not be grounds for rejection (see Note 7). Surface conditions related to deficiencies related to design, detailing, or fabrication as addressed by Practice A385 shall not be grounds for rejection. The zinc coating on threaded components of articles galvanized under this specification shall conform to that required in Specification A153/A153M. Surfaces that remain uncoated after galvanizing shall be renovated in accordance with the methods in Practice A780 unless directed by the purchaser to leave the uncoated areas untreated for subsequent renovation by the purchaser.

6.2.1 Each area subject to renovation shall be 1 in. [25 mm] or less in its narrowest dimension.

6.2.2 The total area subject to renovation on each article shall be no more than ½ of 1 % of the accessible surface area to be coated on that article, or 36 in.<sup>2</sup> per short ton [256 cm<sup>2</sup> per metric ton] of piece weight, whichever is less.

NOTE 5—Inaccessible surface areas are those which cannot be reached for appropriate surface preparation and application of repair materials as described in Practice A780. Such inaccessible areas, for example, would be the internal surfaces of certain tanks, poles, pipes, tubes, and so forth.

6.2.3 The thickness of renovation shall be that required by the thickness grade for the appropriate material category and thickness range in Table 1 in accordance with the requirements of 6.1, except that for renovation using zinc paints, the thickness of renovation shall be 50 % higher than that required by Table 1, but not greater than 4.0 mils.

6.2.4 When areas requiring renovation exceed the criteria previously provided, or are inaccessible for repair, the coating shall be rejected.

NOTE 6—The requirements for the finish of a galvanized product address themselves to a visual type of inspection. They do not address the matter of measured coating thickness variations that can be encountered because of different steels or different thicknesses of a given steel being used in an assembly.

NOTE 7—Items which are prepared for galvanizing by abrasive cleaning will generally develop a thicker coating with a moderately rougher surface.

**6.3 Threaded Components in Assemblies**—The zinc coating on external threads shall not be subjected to a cutting, rolling, or finishing tool operation, unless specifically authorized by the purchaser. Internal threads are not prohibited from being tapped or retapped after galvanizing. Coatings shall conform to the requirements of Specification A153/A153M.

**6.4 Appearance**—Upon shipment from the galvanizing facility, galvanized articles shall be free from uncoated areas, blisters, flux deposits, and gross gross inclusions. Lumps, projections, globules, or heavy deposits of zinc which will interfere with the intended use of the material will not be





permitted. Plain holes of ½-in. [12.5-mm] diameter or more shall be clean and reasonably free from excess zinc. Marks in the zinc coating caused by tongs or other items used in handling the article during the galvanizing operation shall not be cause for rejection unless such marks have exposed the base metal and the bare metal areas exceed allowable maximums from 6.2.1 and 6.2.2. The pieces shall be handled so that after galvanizing they will not freeze together on cooling.

NOTE 8—Depending upon product design or material thickness, or both, filming or excess zinc buildup in plain holes of less than ½-in. [12.5-mm] diameter may occur that requires additional work to make the holes usable as intended.

6.5 *Adherence*—The zinc coating shall withstand handling consistent with the nature and thickness of the coating and the normal use of the article, without peeling or flaking.

NOTE 9—Although some material may be formed after galvanizing, in general the zinc coating on the articles covered by this specification is too heavy to permit severe bending without damaging the coating.

## 7. Sampling

7.1 Sampling of each lot shall be performed for conformance with the requirements of this specification.

7.2 A lot is a unit of production or shipment from which a sample is taken for testing. Unless otherwise agreed upon between the galvanizer and the purchaser, or established within this specification, the lot shall be as follows: For testing at a galvanizer's facility, a lot is one or more articles of the same type and size comprising a single order or a single delivery load, whichever is the smaller, or any number of articles identified as a lot by the galvanizer, when these have been galvanized within a single production shift and in the same bath. For test by the purchaser after delivery, the lot consists of the single order or the single delivery load, whichever is the smaller, unless the lot identity, established in accordance with the above, is maintained and clearly indicated in the shipment by the galvanizer.

7.3 The method of selection and number of test specimens shall be agreed upon between the galvanizer and the purchaser. Otherwise, the test specimens shall be selected at random from each lot. In this case, the minimum number of specimens from each lot shall be as follows:

Number of Pieces in Lot	Number of Specimens
3 or less	all
4 to 500	3
501 to 1 200	5
1 201 to 3 200	8
3 201 to 10 000	13
10 001 and over	20

NOTE 10—Where a number of identical items are to be galvanized, a statistical sampling plan may be desired. Such a plan is contained in Test Method B602 which addresses sampling procedures for the inspection of electrodeposited metallic coatings and related finishes. If Test Method B602 is used, the level of sampling shall be agreed upon between the galvanizer and the purchaser at the time the coating order is placed.

7.4 A test specimen which fails to conform to a requirement of this specification shall not be used to determine the conformance to other requirements.

## 8. Test Methods

8.1 *Test Requirements*—The following tests shall be conducted to ensure that the zinc coating is being furnished in accordance with this specification. The specifying of tests for adhesion and embrittlement shall be subject to mutual agreement between the galvanizer and purchaser. Visual inspection of the coating shall be made for compliance with the requirements.

8.2 *Thickness of Coating Test*—The thickness of coating is determined by one or more of the three methods described as follows.

8.2.1 *Magnetic Thickness Measurements*—The thickness of the coating shall be determined by magnetic thickness gage measurements in accordance with Practice E376 unless the methods described in 8.2.2, 8.2.3, or 8.2.4 are used. For each specimen (as described in 3.2.9) five or more measurements shall be made at points widely dispersed throughout the volume occupied by the specimen so as to represent as much as practical, the entire surface area of the test specimen. The average of the five or more measurements thus made for each specimen is the specimen coating thickness.

8.2.1.1 For articles whose surface area is greater than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>] (multi-specimen articles as described in 3.2.6), the average of the three specimen coating thickness grades comprising each test article is the average coating thickness for that test article. A specimen must be evaluated for each steel category and material thickness within the requirements for each specimen of the test article.

8.2.1.2 For articles whose surface area is equal to or less than 160 in.<sup>2</sup> [100 000 mm<sup>2</sup>] (single-specimen articles as described in 3.2.8), the average of all specimen coating thickness grades is the average coating thickness for the sample.

8.2.1.3 In the case of threaded components, the thickness of coating shall be made on a portion of the article that does not include any threads.

8.2.1.4 The use of magnetic measurement methods is appropriate for larger articles, and is appropriate for smaller articles when there is sufficient flat surface area for the probe tip to sit flat on the surface using Practice E376.

8.2.2 *Stripping Method*—The average weight of coating shall be determined by stripping a test article, a specimen removed from a test article, or group of test articles in the case of very small items such as nails, etc., in accordance with Test Method A90/A90M unless the methods described in 8.2.1, 8.2.3, or 8.2.4 are used. The weight of coating per unit area thus determined is converted to equivalent coating thickness values in accordance with Table 2 (rounding up or down as appropriate). The thickness of coating thus obtained is the test article coating thickness, or in the case of a specimen removed from a test article, is the specimen average coating thickness.

8.2.2.1 The stripping method is a destructive test and is appropriate for single specimen articles, but is not practical for multi-specimen articles.

8.2.3 *Weighing Before and After Galvanizing*—The average weight of coating shall be determined by weighing articles before and after galvanizing, subtracting the first weight from the second and dividing the result by the surface area unless the





methods described in 8.2.1, 8.2.2, or 8.2.4 are used. The first weight shall be determined after pickling and drying and the second after cooling to ambient temperature. The weight of coating per unit area thus determined is converted to equivalent coating thickness values according to Table 2 (rounding up or down as appropriate). The thickness of coating thus obtained is the test article coating thickness.

8.2.3.1 The weighing before and after method is appropriate for single-specimen articles, but is not practical for multi-specimen articles.

NOTE 11—Both the stripping method and the weighing before and after method do not take into account the weight of iron reacted from the article that is incorporated into the coating. Thus, the methods may underestimate coating weight (and therefore the calculated thickness) by up to 10 %. The accuracy of both methods will be influenced by the accuracy to which the surface area of the articles tested can be determined.

8.2.4 *Microscopy*—The thickness of coating shall be determined by cross-sectional and optical measurement in accordance with Test Method B487 unless the methods described in 8.2.1, 8.2.2, or 8.2.3 are used. The thickness thus determined is a point value. No less than five such measurements shall be made at locations on the test article which are as widely dispersed as practical, so as to be representative of the whole surface of the test article. The average of no less than five such measurements is the specimen coating thickness.

8.2.4.1 The microscopy method is a destructive test and is appropriate for single-specimen articles, but is not practical for multi-specimen articles.

8.2.5 *Referee Method*—In the event of a dispute over thickness of coating measurements, the dispute shall be resolved as follows:

8.2.5.1 For multi-specimen articles, a new sample shall be taken randomly from the lot of material, which has twice the number of test articles as the sample which failed to conform to this specification. If the lot size is such that the sample size cannot be doubled, then the sample size shall be as previous, but the number of widely dispersed sites at which measurements were made shall be doubled, and these sites will constitute the new sample. This new sample shall be measured using magnetic thickness gages which have been calibrated for accuracy against reference material thickness standards. If the lot is found to be nonconforming by the new sample, the galvanizer has the right to sort the lot for conforming articles by individual test, to re-galvanize non-conforming articles, or to renovate the nonconforming articles in accordance with 6.2.

8.2.5.2 For single-specimen articles, a new sample shall be taken randomly from the lot of material, which has twice the number of test articles as the sample which failed to conform to this specification. The test method for the new sample shall be selected by mutual agreement between the purchaser and galvanizer. If the lot is found to be nonconforming by the new sample, the galvanizer has the right to sort the lot for conforming articles by individual test, to re-galvanize non-conforming articles, or to renovate the nonconforming articles in accordance with 6.2.

8.3 *Adhesion*—Determine adhesion of the zinc coating to the surface of the base metal by cutting or prying with the point of a stout knife, applied with considerable pressure in a manner

tending to remove a portion of the coating. The adhesion shall be considered inadequate if the coating flakes off in the form of a layer of the coating so as to expose the base metal in advance of the knife point. Do not use testing carried out at edges or corners (points of lowest coating adhesion) to determine adhesion of the coating. Likewise, do not use removal of small particles of the coating by paring or whittling to determine failure.

8.4 *Embrittlement*—Test for embrittlement shall be made in accordance with Practice A143/A143M. These tests shall not be required unless strong evidence of embrittlement is present.

## 9. Inspection, Rejection, and Retest

9.1 *Inspection by the Galvanizer*—It is the responsibility of the galvanizer to ensure compliance with this specification. This shall be achieved by an in-plant inspection program designed to maintain the coating thickness, finish, and appearance within the requirements of this specification unless the inspection is performed in accordance with 9.2.

9.2 *Inspection By the Purchaser*—The purchaser shall accept or reject material by inspection either through the galvanizer's inspector, the purchaser's inspector, or an independent inspector. The inspector representing the purchaser shall have access at all times to those areas of the galvanizer's facility which concern the application of the zinc coating to the material ordered while work on the contract of the purchaser is being performed. The galvanizer shall afford the inspector all reasonable facilities to satisfy him that the zinc coating is being furnished in accordance with this specification.

9.3 *Location*—The material shall be inspected at the galvanizer's plant prior to shipment. However, by agreement the purchaser is not prohibited from making tests which govern the acceptance or rejection of the materials in his own laboratory or elsewhere.

9.4 *Reinspection*—When inspection of materials to determine conformity with the visual requirements of 6.2 warrants rejection of a lot, the galvanizer is not prohibited from sorting the lot and submit it once again for acceptance after he has removed any nonconforming articles and replaced them with conforming articles.

9.5 The sampling plan that was used when the lot was first inspected shall be used for resampling of a sorted lot. By mutual agreement, the galvanizer is not prohibited from submitting the lot remaining after sorting and removing nonconforming articles without replacement of the nonconforming articles. In such case, the now-smaller lot shall be treated as a new lot for purposes of inspection and acceptance.

9.6 Materials that have been rejected for reasons other than embrittlement are not prohibited from being stripped and regalvanized and again submitted for inspection and test at which time they shall conform to the requirements of this specification.

## 10. Certification

10.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed by this specification and the requirements have been met.





When specified in the purchase order or contract, a report of the test results shall be furnished.

## 11. Keywords

11.1 coatings—zinc; galvanized coatings; steel products—metallic coated; zinc coatings—steel products

## SUMMARY OF CHANGES

Committee A05 has identified the location of selected changes to this standard since the last issue (A123/A123M - 09) that may impact the use of this standard. (May 15, 2012)

(I) Revised **Table 1**.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

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# Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement<sup>1</sup>

This standard is issued under the fixed designation A 143/A 143M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 This practice covers procedures that can be followed to safeguard against the possible embrittlement of steel hot-dip galvanized after fabrication, and outlines test procedures for detecting embrittlement. Conditions of fabrication may induce a susceptibility to embrittlement in certain steels that can be accelerated by galvanizing. Embrittlement is not a common occurrence, however, and this discussion does not imply that galvanizing increases embrittlement where good fabricating and galvanizing procedures are employed. Where history has shown that for specific steels, processes and galvanizing procedures have been satisfactory, this history will serve as an indication that no embrittlement problem is to be expected for those steels, processes, and galvanizing procedures.

1.2 This practice is applicable in either inch-pounds or SI units. Inch-pounds and SI units are not necessarily exact equivalents. Within the text of this practice and where appropriate, SI units are shown in brackets.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.13 on Structural Shapes and Hardware Specifications.

Originally Prepared by Subcommittee A05.10 on Embrittlement Investigation of Committee A05 on Corrosion of Iron and Steel and based on an investigation made by Battelle Memorial Institute under American Society for Testing and Materials' sponsorship. See *Proceedings*, Am. Soc. Testing Mats., Vol 31, Part I, 1931, p. 211; also paper by Samuel Epstein, "Embrittlement of Hot-Dip Galvanized Structural Steel," see *Proceedings*, Am. Soc. Testing Mats., Vol 32, Part II, 1932, p. 293.

Current edition approved May 1, 2007. Published June 2007. Originally approved in 1932. Last previous edition approved in 2003 as A 143/A 143M - 03.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

## 3. Terminology

### 3.1 Definition:

3.1.1 *embrittlement, n*—the loss or partial loss of ductility in a steel where an embrittled product characteristically fails by fracture without appreciable deformation; types of embrittlement usually encountered in galvanized steel are related to aging phenomena, cold working, and absorption of hydrogen.

## 4. Factors in Embrittlement

4.1 Embrittlement or loss of ductility in steel is often associated with strain-aging. Strain-aging refers to the delayed increase in hardness and strength, and loss of ductility and impact resistance which occur in susceptible steels as a result of the strains induced by cold working. The aging changes proceed slowly at room temperature, but proceed at an accelerated rate as the aging temperature is raised and may occur rapidly at the galvanizing temperature of approximately 850°F [455°C].

4.2 Hydrogen embrittlement may also occur due to the possibility of atomic hydrogen being absorbed by the steel. The susceptibility to hydrogen embrittlement is influenced by the type of steel, its previous heat treatment, and degree of previous cold work. In the case of galvanized steel, the acid pickling reaction prior to galvanizing presents a potential source of hydrogen. However, the heat of the galvanizing bath partially expels hydrogen that may have been absorbed. In practice hydrogen embrittlement of galvanized steel is usually of concern only if the steel exceeds approximately 150 ksi [1100 MPa] in ultimate tensile strength, or if it has been severely cold worked prior to pickling.

4.3 Loss of ductility of cold-worked steels is dependent on many factors including the type of steel (strength level, aging characteristics), thickness of steel, and degree of cold work, and is accentuated by areas of stress concentration such as caused by notches, holes, fillets of small radii, sharp bends, etc.



4.4 Low temperatures increase the risk of brittle failure of all plain carbon steels including steel that has been galvanized. The rate at which this temperature loss of ductility occurs varies for different steels. The expected service temperature should thus be taken into account when selecting the steel.

## 5. Steels

5.1 Open-hearth, basic-oxygen, and electric-furnace steels shall be used for galvanizing. Other materials that can be galvanized include continuous cast slabs, steel or iron castings, and wrought iron.

## 6. Cold Working and Thermal Treatment

6.1 For intermediate and heavy shapes, plates, and hardware, cold bend radii should not be less than that which is proven satisfactory by practice or by the recommendations of the steel manufacturer. These criteria generally depend on the direction of grain, strength, and type of steel. A cold bending radius of three times (3×) the section thickness, or as recommended in *AISC Manual of Steel Construction*,<sup>3</sup> will ordinarily ensure satisfactory properties in the final product. Although sharper bending on thin sections can usually be tolerated, embrittlement may occur if cold bending is especially severe. If the design requires sharper bending than discussed herein, the bending should be done hot, or if done cold the material should be subsequently annealed or stress relieved as noted in 6.3.

6.2 Smaller shapes, including thickness up to ¼ in. [6.4 mm] may be cold worked by punching without subsequent annealing or stress-relieving. Shapes ⅝ to 1½ in. [8 to 18 mm] in thickness are not seriously affected as to serviceability by cold punching or if the punching is done under good shop practice. The heavier shapes, ¾ in. [19 mm] and over, shall be reamed with at least ⅛ in. [1.6 mm] of metal removed from the periphery of the hole after punching, or shall be drilled, or thermally treated prior to galvanizing as noted in 6.3.

6.3 Fabrication in accordance with the principles outlined in 6.1 and 6.2 will normally obviate the need for thermal treatment. However, if required, proper thermal treatment shall precede galvanizing of the steel. For heavy cold deformation exemplified by cold rolling, sheared edges, punched holes, or cold-formed rods and bolts, subcritical annealing at temperatures from 1200 to 1300°F [650 to 705°C] should be employed. For less severe cold deformation typified by cold bending, roll forming, etc., it is advisable to limit the thermal treatment to stress relieving at a maximum of 1100°F [595°C] to avoid excessive grain growth or alternatively to fully normalize the steel at temperatures from 1600 to 1700°F [870 to 925°C]. The time at temperature should be approximately 1 h/in. [24 min/cm] of section thickness.

6.4 Flame cut copes on structural beams shall have a minimum radius of 1 in. [2.5 cm]. After cutting, the cut surface shall be ground to remove notches, grooves, and irregular surface features to leave the surface smooth.

## 7. Preparation for Galvanizing

7.1 Hydrogen can be absorbed during pickling and in some instances, as noted in 4.2, may contribute to embrittlement of the galvanized product. The likelihood of this, or of surface cracking occurring, is increased by excessive pickling temperature, prolonged pickling time, and poor inhibition of the pickling acid. Heating to 300°F [150°C] after pickling and before galvanizing in most cases results in expulsion of hydrogen absorbed during pickling.

7.2 Abrasive blast cleaning followed by flash pickling may also be employed when over-pickling is of concern or when very high strength steel, ultimate tensile strength higher than 150 ksi [1100 MPa], must be galvanized. The abrasive blast cleaning does not generate hydrogen while it is cleaning the surface of the steel. The flash pickling after abrasive blast cleaning is used to remove any final traces of blast media before hot-dip galvanizing.

## 8. Responsibility for Avoiding Embrittlement

8.1 Design of the product and selection of the proper steel to withstand normal galvanizing operations without embrittlement are the responsibility of the designer. The fabricator shall be responsible for employing suitable fabrication procedures. The galvanizer shall employ proper pickling and galvanizing procedures.

## 9. Testing for Embrittlement of Steel Shapes, Steel Castings, Threaded Articles, and Hardware Items

9.1 Subject to base material and dimensional limitations, the tests given in 9.2, 9.3, 9.4, or 9.5, or a combination thereof, shall apply. If one test specimen should be found embrittled by these tests, two additional specimens should be tested. Failure of either the second or the third specimen shall be cause for rejection of the lot (see Note 1) that the samples represent.

NOTE 1—A lot is a unit of production from which a sample may be taken for testing. Unless otherwise agreed upon by the manufacturer and the purchaser, or established within this practice, the lot shall be as follows: For test at a manufacturer's facility, a lot is one or more articles of the same type and size comprising a single order or a single delivery load, whichever is the smaller, or a smaller number of articles identified as a lot by the manufacturer, when these have been galvanized within a single production shift. For test by purchaser after delivery, the lot consists of the single order or the single delivery load, whichever is the smaller, unless the lot identity, established in accordance with the above, is maintained and clearly indicated in the shipment by the manufacturer.

9.2 A bend test for embrittlement of galvanized steel hardware such as bolts, pole and tower steps, braces, rods, reinforcing bars, etc., consists of bending the article and comparing the degree of bending to that which is obtained on a similar ungalvanized article. The article, before and after galvanizing, may be clamped in a vise and using a lever if necessary, bent until cracking of the base steel occurs, or to 90° whichever is less. The galvanized article should withstand a degree of bending substantially the same as the ungalvanized article. Flaking or spalling of the galvanized coating is not to be construed as an embrittlement failure. For threaded articles, the test shall be made on the unthreaded portion.

9.3 Small steel castings and steel hardware of such shape or size that do not permit bending may be struck a sharp blow

<sup>3</sup> Available from American Institute of Steel Construction (AISC), One East Wacker Drive, Suite 3100, Chicago, IL 60601-2001. 9<sup>th</sup> Edition.

with a 2-lb [1-kg] hammer and the results for both galvanized and ungalvanized samples compared. If the article withstands such a blow in the ungalvanized condition, but after galvanizing cracks under the blow, it shall be considered embrittled.

9.4 A test for embrittlement of galvanized steel angles is detailed as follows:

9.4.1 *Test Specimen*—A test specimen with a length determined by the table in 9.4.2.1 and by Fig. 1 shall be cut from the steel angle before galvanizing. A hole shall be made in the test specimen at its midlength, using the same procedure as will be employed in the fabricated material which the specimen represents, whether this be by punching, punching and reaming, or drilling. The dimensional values, diameter, and location of hole shall be not less than those employed in the structural details. Care should be taken not to place the hole near stamped or rolled-in identification marks. The specimen shall then be galvanized. For determining the elongation after fracture, a 2-in. [51-mm] gage length (Fig. 1) shall be prick-punched in the middle of the edge of the vertical leg of the galvanized angle along a line parallel to its length and centered directly under the hole. For specimens under ½ in. [13 mm] in thickness, or those in which the distance from the edge of the hole to the edge of the angle is less than ⅜ in. [10 mm], a 1-in. [25-mm] gage length shall be used.

#### 9.4.2 Procedure:

9.4.2.1 The test shall be made in a universal testing machine, or by other means such as a press with the load applied slowly, until fracture of the galvanized test specimen occurs. The length of the test specimen and the distance between the supports are shown in the following table:

Leg of Angle, <i>l</i> , in. [mm] (see Fig. 1)	Length Between Supports, <i>L</i> <sub>1</sub> , in. [mm]	Minimum Length, <i>L</i> <sub>2</sub> , in. [mm]
Up to 4 [102], incl	14 [356]	18 [457]
Over 4 to 6 [102 to 152], incl	20 [508]	24 [610]
Over 6 to 8 [152 to 203], incl	30 [762]	36 [914]

9.4.2.2 After the test, the distance along the gage length from each punch mark to the corresponding edge of the fracture shall be measured to 0.01 in. [0.25 mm] with a flexible scale and the percentage of elongation calculated from the sum of these distances.

9.4.2.3 For determining the percentage reduction of thickness after fracture, the reduction shall be measured with a ball-point micrometer at the three locations indicated in Fig. 2: namely *a*, outer side of hole; *b*, inner side of hole; and *c*, middle of leg. The percentage reduction of thickness shall be calculated on the basis of the original thickness of the angle and the average of the three values at *a*, *b*, and *c*.

9.4.2.4 The test shall be made upon galvanized specimens having a temperature not below 60°F [16°C] and not over 90°F [32°C] when tested.

9.4.3 *Requirements*—The elongation measured in accordance with 9.4.2.2 shall be not less than 5 % with the following exception: when the specimen does not show 5 % elongation, the reduction in thickness shall be measured in accordance with 9.4.2.3. The sum of the percentage of elongation plus the average percentage reduction of thickness shall not be less than 10.

9.5 For hot-dip galvanized externally threaded fasteners, an alternate test to Section 9.2 for embrittlement is detailed in Test Method F 606.

## 10. Keywords

10.1 coatings-zinc; galvanized coatings; steel products-metallic coated; zinc coatings-steel products

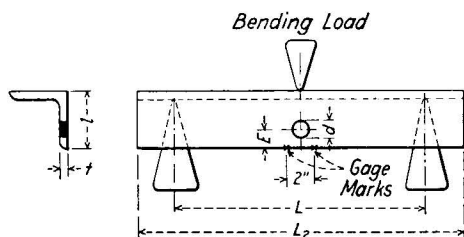


FIG. 1 Specimen for Elongation after Fracture

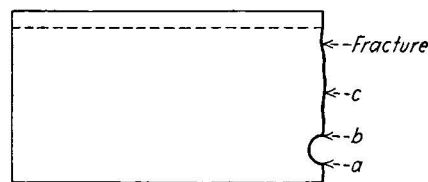


FIG. 2 Measurement of Reduction of Thickness after Fracture

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## Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware<sup>1</sup>

This standard is issued under the fixed designation A 153/A 153M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope\*

1.1 This specification covers zinc coatings applied by the hot-dip process on iron and steel hardware. The hot-dip galvanizing process consists of parts being immersed in molten zinc for a sufficient time to allow a metallurgical reaction between iron from the steel surface and the molten zinc, resulting in the formation of Zn/Fe alloy layers bonding the coating to the steel surface.

1.2 This specification is intended to be applicable to hardware items that are centrifuged or otherwise handled to remove excess galvanizing bath metal (free zinc). Coating thickness grade requirements reflect this.

1.3 This specification is applicable to orders in either inch-pound units (as A 153) or in SI units (as A 153M). Inch-pound units and SI units are not necessarily exact equivalents. Within the text of this specification and where appropriate, SI units are shown in brackets. Each system shall be used independently of the other without combining values in any way. In the case of orders in SI units, all testing and inspection shall be done using the metric equivalent of the test or inspection method as appropriate. In the case of orders in SI units, such shall be stated to the galvanizer when the order is placed.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

- A 90/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
- A 143/A 143M Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
- A 780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- A 902 Terminology Relating to Metallic Coated Steel Products
- B 6 Specification for Zinc
- B 487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section
- B 960 Specification for Prime Western Grade-Recycled (PWG-R) Zinc
- E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods
- F 1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
- F 1789 Terminology for F16 Mechanical Fasteners

### 3. Terminology

#### 3.1 Definitions:

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.13 on Structural Shapes and Hardware Specifications.

Current edition approved May 1, 2009. Published May 2009. Originally approved in 1933. Last previous edition approved in 2005 as A 153/A 153M - 05.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard.

3.1.1 The following terms and definitions are specific to this specification. Terminology **A 902** contains other terms and definitions relating to metallic-coated steel products. Terminology **F 1789** contains other terms and definitions relating to mechanical fasteners.

**3.2 Definitions of Terms Specific to This Standard:**

3.2.1 *average coating thickness, n*—the average of the specimen coating thickness values for the samples in an inspection lot.

3.2.2 *bare spots, n*—uncoated areas on the surface of the steel part that contain no measurable zinc coating.

3.2.3 *dross inclusions, n*—the iron/zinc intermetallics present in a galvanized coating in a form other than the layer growth of the coating.

3.2.4 *individual measurement, n*—the reading from a magnetic thickness gauge of a single coating spot thickness, or the microscopic reading of a coating thickness as seen in an optical microscope at one spot.

3.2.5 *inspection lot, n*—the quantity of identical parts cleaned, fluxed and galvanized together at one time in an appropriate container that is being submitted for acceptance as a group.

3.2.6 *malleable casting, n*—a steel article that has been subjected to a prolonged anneal to decarburize or graphitize the part to remove as much of the carbon as possible or to convert the carbon to graphite, which permits plastic deformation in compression without rupture.

3.2.7 *sample, n*—a collection of individual units of product from a single inspection lot selected in accordance with Section 6 and intended to represent that inspection lot for acceptance.

3.2.8 *specimen, n*—an individual test article upon which thickness measurements or weight determinations are performed.

3.2.9 *specimen coating thickness, n*—the average thickness from no less than five test measurements on a specimen, when each measurement location is selected to provide the widest dispersion (in all applicable directions) of locations within the specimen volume.

3.2.10 *threaded areas, n*—the sections of a steel part that have threads formed before hot-dip galvanizing.

**4. Materials and Manufacture**

4.1 *Steel or Iron*—Ferrous articles to be hot-dip zinc coated shall conform to specifications designated by the purchaser.

4.2 *Zinc*—The zinc used for the coating shall conform to Specification **B 6**, or Specification **B 960**, or both, and shall be at least equal to the grade designated as “Prime Western.”

4.2.1 If a zinc alloy is used as the primary feed for the galvanizing bath, then the base material used to make that alloy shall conform to Specification **B 6** or Specification **B 960**, or both.

4.2.2 The molten metal in the working volume of the galvanizing bath shall contain not less than an average value of 98.0 % zinc by weight [mass].

NOTE 1—The galvanizer may choose to add trace amounts of certain elements (for example, aluminum, nickel, bismuth, or tin) to the zinc bath to help in the processing of certain reactive steels or to enhance the cosmetic appearance of the finished product. The elements can be added to the galvanizing bath as a master feed alloy, or they can be added to the bath by the galvanizer as individual feeds.

4.3 *Minimum Coating Weight [Mass] or Minimum Coating Thickness*—The minimum coating weight [mass] or the minimum coating thickness shall conform to the requirements prescribed in **Table 1** for the material category and thickness of material in which the article belongs.

4.4 *Threaded Articles*—The zinc coating on threads shall not be subjected to a cutting, rolling, or finishing-tool operation, unless specifically authorized by the purchaser. In order to meet overlapping allowances, tapping the threads of nuts or tapped holes after galvanizing is not prohibited.

4.5 *Touch-up and Repair*—Bare spots that are found on parts after galvanizing shall be renovated by use of the methods found in Practice **A 780** if the following criteria are met. The bare spots shall have an area totalling not more than 1 % of the surface area to be coated excluding threaded areas of the piece and the bare spots shall not include any threaded areas of the

**TABLE 1 Thickness or Weight [Mass] of Zinc Coating for Various Classes of Material**

NOTE 1—Length of the piece, stated in Classes B-1, B-2, and B-3, refers to the finished dimension of the piece after fabrication.

Class of Material	Weight [Mass] of Zinc Coating, oz/ft <sup>2</sup> [g/m <sup>2</sup> ] of Surface, Minimum		Coating Thickness, mils [microns], Minimum	
	Average of Specimens Tested	Any Individual Specimen	Average of Specimens Tested	Any Individual Specimen
<i>Class A</i> —Castings—Malleable Iron, Steel	2.00 [610]	1.80 [550]	3.4 [86]	3.1 [79]
<i>Class B</i> —Rolled, pressed, and forged articles (except those which would be included under Classes C and D):				
B-1— $\frac{3}{16}$ in. [4.76 mm] and over in thickness and over 15 in. [381 mm] in length	2.00 [610]	1.80 [550]	3.4 [86]	3.1 [79]
B-2—under $\frac{3}{16}$ in. [4.76 mm] in thickness and over 15 in. [381 mm] in length	1.50 [458]	1.25 [381]	2.6 [66]	2.1 [53]
B-3—any thickness and 15 in. [381 mm] and under in length	1.30 [397]	1.10 [336]	2.2 [56]	1.9 [48]
<i>Class C</i> —Fasteners over $\frac{3}{16}$ in. [9.52 mm] in diameter and similar articles. Washers $\frac{3}{16}$ in. and $\frac{1}{4}$ in. [4.76 and 6.35 mm] in thickness	1.25 [381]	1.00 [305]	2.1 [53]	1.7 [43]
<i>Class D</i> —Fasteners $\frac{3}{16}$ in. [9.52 mm] and under in diameter, rivets, nails and similar articles. Washers under $\frac{3}{16}$ in. [4.76 mm] in thickness	1.00 [305]	0.85 [259]	1.7 [43]	1.4 [36]



piece. The thickness of the repair shall be equal to the surrounding galvanized coating except for repairs made by paints containing zinc dust in which case the thickness of the repair shall be 50 % greater than the thickness of the galvanized coating required for the class of material, but shall not be greater than 4.0 mils [100  $\mu\text{m}$ ]. Repair thickness measurements shall be made in accordance with Practice **A 780**. The galvanizer shall make repairs unless directed by the purchaser to deliver items unrepaired for subsequent renovation by the purchaser.

## 5. Workmanship, Finish, and Appearance

5.1 The zinc-coated articles shall be free from uncoated areas, blisters, flux deposits, dross inclusions, and other types of projections that would interfere with the intended use of the articles, or other defects not consistent with good galvanizing practice.

5.2 The zinc coating shall be smooth and reasonably uniform in thickness.

**NOTE 2**—Smoothness of surface is a relative term. Minor roughness that does not interfere with the intended use of the part, or roughness that is related to the as-received (ungalvanized) surface condition of the part, shall not be grounds for rejection.

**NOTE 3**—Since this specification is applicable to items that are centrifuged or otherwise handled to remove excess bath metal (see **1.2**), irregular coating distribution is not normally encountered. Drainage problems, which manifest themselves as local excess coating thickness that would interfere with function or as edge tears or spikes that present a safety hazard because of their sharpness, are grounds for rejection under the terms of **5.1**.

5.3 Embrittlement is a potential condition of steel that is cold-worked, depending on such factors as the steel type (strength level, aging characteristics), thickness, degree of cold work, and galvanizing process. The galvanizer, the designer and the fabricator shall take precautions against embrittlement. The precautions to fabricate properly and prepare the material for galvanizing to prevent embrittlement are described in Practice **A 143/A 143M**.

**NOTE 4**—Low service temperatures increase the risk of brittle failure of all plain carbon steels including those which have been galvanized. This temperature embrittling effect varies with type of steel. The expected service temperature should thus be taken into account when selecting steels for galvanizing.

5.4 Malleable castings shall be of such composition as will preclude the possibility that they become embrittled by the galvanizing process, or they shall be either cooled from the anneal, or subsequently heat-treated so as to immunize them against embrittlement.

5.5 The zinc coating shall adhere tenaciously to the surface of the base metal.

5.6 If the galvanized material covered by this specification is bent or otherwise fabricated to the degree that causes the zinc coatings to stretch or compress beyond the limit of elasticity, any cracking or flaking of the coating resulting from the bending or fabricating shall not be cause for rejection.

## 6. Sampling

6.1 Test specimens shall be selected at random from each inspection lot.

6.2 The method of selection and sample size shall be agreed upon between the galvanizer and the purchaser. Otherwise, the sample size selected from each lot shall be as follows:

Number of Pieces in Lot	Sample Size
3 or less	all
4 to 500	3
501 to 1200	5
1201 to 3200	8
3201 to 10 000	13
10 001 and over	20

6.3 A specimen that fails to conform to a requirement of this specification shall not be used to determine the conformance to other requirements.

6.4 The method of sampling for fasteners that are required to meet the standards of the Fastener Quality Act is described in Guide **F 1470**. Sample quantities and definitions of terminology are included in the referenced specification.

## 7. Test Methods

7.1 Tests shall be made to ensure that the zinc coating is being furnished in accordance with this specification and as specified for the following:

7.1.1 Minimum coating weight [mass] or minimum coating thickness in **4.3**.

7.1.2 Finish and appearance in **5.1** and **5.2**.

7.1.3 Embrittlement in **5.3** and **5.4**.

7.1.4 Adherence in **5.5**.

7.2 *Average Weight [Mass] of Coating:*

7.2.1 The average weight [mass] of the zinc coating shall be determined by weighing specimens after pickling and drying and again after galvanizing unless the method described in **7.2.2** is used. The number of specimens that are used to determine the average of an inspection lot shall be derived from Section **6**.

**NOTE 5**—This method does not take into account the weight [mass] of iron reacted from the article that is incorporated into the coating. It will thus underestimate coating weight [mass] by up to approximately 10 %. Base metal reactivity will affect the extent of underestimation.

7.2.2 In the case of materials inspected after galvanizing, the average weight [mass] of coating shall be determined by stripping the number of specimens derived in Section **6** in accordance with Test Method **A 90/A 90M**, and averaging the results of the individual specimens, unless the method described in **7.2.1** is used.

7.3 *Average Thickness of Coating:*

7.3.1 In the case of fasteners such as bolts, nuts, and screws, the determination of the thickness of coating shall be made on a portion of the article that does not include any threads.

7.3.2 The average thickness of coating shall be determined by magnetic thickness gage in accordance with Practice **E 376** unless the method described in **7.3.3** is used. The thickness shall be measured on at least five widely separated spots on a specimen. No individual spot measurement shall be cause for rejection. If an individual spot does not provide a coating thickness reading, this spot must be repaired in accordance with **4.5**. The five or more individual coating thickness measurements on a specimen must be averaged to determine the specimen average coating thickness. The average coating thickness for the inspection lot is determined by averaging the



specimen average coating thickness values for the number of specimens derived from Section 6.

7.3.3 The thickness of coating shall be determined by cross section and optical measurement in accordance with Test Method B 487, unless the method described in 7.3.2 is used. The thickness thus determined is a point value. No less than five such measurements shall be made at locations on the specimen, which are as widely dispersed as practical, so as to be representative of the whole surface of the specimen. The average of no less than five such measurements is the specimen average coating thickness. The average coating thickness for the inspection lot is determined by averaging the specimen average coating thickness values for the number of specimens derived from Section 6.

7.4 *Finish and Appearance*—The test for finish and appearance shall be conducted through visual inspection without additional magnification.

7.5 *Embrittlement*—Hardware that is susceptible to embrittlement shall be tested in accordance with Practice A 143/A 143M. The tests shall be performed through agreement between the galvanizer and the purchaser.

7.6 *Adherence*—Determine adherence of the zinc coating to the surface of the base metal by cutting or prying with the point of a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating. The adherence shall be considered inadequate if the coating delaminates in the form of a layer of skin so as to expose the base metal in advance of the knife point. Do not use testing carried out at edges or corners (points of lowest coating adherence) to determine adherence of coating. Likewise, do not use removal of small particles of the coating by paring or whittling to determine failure.

## 8. Inspection

8.1 The inspector representing the purchaser shall have access at all times while work on the contract of the purchaser is being performed, to those areas of the manufacturer's work which concern the application of the zinc coating to the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the zinc coating is being furnished in accordance with this specification. All inspection and tests shall be made at the place of manufacture

prior to shipments, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

## 9. Rejection and Retest

9.1 For all galvanized articles except those fasteners that must meet the requirements of the Fastener Quality Act, the following sections are used to determine rejection and retesting.

9.2 When partial inspection of materials to determine conformity with visual requirements of Section 5 warrants rejection of a lot, the galvanizer is not prohibited from sorting the lot and submitting it once again for inspection.

9.3 The number of specimens in a sample of a lot permitted to fail to conformance tests shall be agreed upon between the galvanizer and the purchaser.

9.4 If a set of test specimens fails to conform to the requirements of this specification, two additional sets shall be tested, both of which shall conform to the requirements in every respect, or the lot of material represented by the specimens shall be rejected.

9.5 Materials that have been rejected for reasons other than embrittlement are not prohibited from being stripped, regalvanized, and resubmitted for test and inspection. They shall then conform to the requirements of this specification.

## 10. Packaging

10.1 The supplier shall employ such methods of packaging zinc-coated articles as shall be required to ensure their receipt by the purchaser in satisfactory condition, with the use to be made of the article being taken into consideration.

## 11. Certification

11.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each inspection lot have been either tested or inspected as directed by this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

## 12. Keywords

12.1 coatings, zinc; galvanized coatings; steel hardware, zinc coated; steel products, metallic coated; zinc coatings, steel products



**SUMMARY OF CHANGES**

Committee A05 has identified the location of selected changes to this standard since the last issue, A 153/A 153M - 05, that may impact the use of this standard. (May 1, 2009)

(I) Revised 4.2 and 4.2.1 to add new zinc standard B 960.

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# Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners<sup>1</sup>

This standard is issued under the fixed designation A354; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope\*

1.1 This specification<sup>2</sup> covers the chemical and mechanical requirements of quenched and tempered alloy steel bolts, studs, and other externally threaded fasteners 4 in. and under in diameter for application at normal atmospheric temperatures, where high strength is required and for limited application at elevated temperature (**Note 1**). Any alloy steel capable of meeting the minimum mechanical and chemical properties set forth in this specification may be used.

**NOTE 1**—For bolts, studs, or other externally threaded fasteners, to be used at elevated temperatures, refer to Specification **A193/A193M**.

1.2 Two levels of bolting strength are covered, designated Grades BC and BD. Selection will depend upon design and the stresses and service for which the product is to be used.

**NOTE 2**—Quenched and tempered alloy steel bolts for structural steel joints up through 1½ in. in diameter are covered in Specification **A490**. Alloy steel bolts, studs, and other externally threaded fasteners (that is, heavy hex-structural bolts over 1½ in., hex bolts, anchor bolts, and countersunk bolts) exhibiting similar mechanical properties to bolts conforming to Specification **A490** shall be covered by Grade BD of this specification.

When bolts of Grade BD of this specification are considered for pretensioned applications in excess of 50 % of the bolt tensile strength, the additional requirements of head size, maximum tensile strength, nut size and strength, washer hardness, tests, and inspections contained in Specification **A490** should be carefully considered.

1.3 Nuts are covered in Specification **A563**. Unless otherwise specified, the grade and style of nut for each grade of fastener shall be as follows:

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **F16** on Fasteners and is the direct responsibility of Subcommittee **F16.02** on Steel Bolts, Nuts, Rivets and Washers.

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<sup>2</sup> For *ASME Boiler and Pressure Vessel Code* applications see related Specification SA-354 in Section II of that Code.

Grade of Fastener and Surface Finish	Nut Grade and Style <sup>A</sup>
BC, plain (or with a coating of insufficient thickness to require over-tapped nuts)	C, heavy hex
BC, zinc-coated (or with a coating thickness requiring over-tapped nuts)	DH, heavy hex
BD, all finishes	DH, heavy hex

<sup>A</sup> Nuts of other grades and styles having specified proof load stresses (Specification **A563**, Table 3) greater than the specified grade and style of nut are suitable.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 Terms used in this specification are defined in Terminology **F1789** unless otherwise defined herein.

## 2. Referenced Documents

### 2.1 *ASTM Standards*:<sup>3</sup>

**A193/A193M** Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications  
**A490** Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength  
**A563** Specification for Carbon and Alloy Steel Nuts  
**A751** Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products  
**B695** Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel  
**D3951** Practice for Commercial Packaging  
**F436** Specification for Hardened Steel Washers  
**F606** Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard.



**F788/F788M** Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

**F1470** Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

**F1789** Terminology for F16 Mechanical Fasteners

**F2329** Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

2.2 *ASME Standards*.<sup>4</sup>

**B1.1** Unified Screw Threads

**B18.2.1** Square and Hex Bolts and Screws, Inch Series

**B18.24** Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

### 3. Ordering Information

3.1 Orders for bolts and studs (including nuts and accessories) under this specification shall include the following:

3.1.1 ASTM designation and year of issue,

3.1.2 Name of product (that is, bolt or stud),

3.1.3 Grade (that is, BC or BD),

3.1.4 Quantities (number of pieces by size, including nuts),

3.1.5 Size and length,

3.1.6 Washers—Specify quantity and size (separate from bolts) (4.3),

3.1.7 *Zinc Coating*—When zinc-coated Grade BC fasteners are required, specify the zinc-coating process required, for example hot-dip, mechanically deposited, or no preference (see 4.4).

3.1.8 *Other Finishes*—Specify other protective finish, if required.

3.1.9 Specify if inspection at point of manufacture is required,

3.1.10 Specify if Certification (Section 14) is required, and

3.1.11 Specify additional testing (Section 9) or special requirements.

3.1.12 For establishment of a part identifying system, see ASME **B18.24**.

### 4. Materials and Manufacture

4.1 The steel shall be made by the open-hearth, electric-furnace, or basic-oxygen process.

4.2 All fasteners shall be heat-treated. At the option of the manufacturer, heat treatment may be performed on the raw material, during the manufacturing operations, or after final machining. Heat treatment shall consist of quenching in a liquid medium (except Grade BD sizes 1½ in. and smaller shall be quenched in oil) from above the transformation temperature and then tempering by reheating to a temperature of not less than 800°F (427°C) for Grade BC and for Grade BD.

4.3 When used, suitable hardened washers shall be quenched and tempered (non-carburized) in accordance with Specification **F436**.

4.4 *Zinc Coatings, Hot-Dip and Mechanically Deposited:*

4.4.1 When zinc-coated fasteners are required, the purchaser shall specify the zinc coating process, for example, hot-dip, mechanically deposited, or no preference.

4.4.2 When “hot-dip” is specified, the fasteners shall be zinc coated by the hot-dip process in accordance with the requirements of Specification **F2329**.

4.4.3 When mechanically deposited is specified, the fasteners shall be zinc-coated by the mechanical-deposition process in accordance with the requirements of Class 55 of Specification **B695**.

4.4.4 When no preference is specified, the supplier may furnish either a hot-dip zinc coating in accordance with Specification **F2329**, or a mechanically deposited zinc coating in accordance with Specification **B695**, Class 55. Threaded components (bolts and nuts) shall be coated by the same zinc-coating process and the supplier’s option is limited to one process per item with no mixed processes in a lot.

NOTE 3—When the intended application requires that assembled tension exceeds 50 % of minimum bolt proof load, an anti-galling lubricant may be needed. Application of such a lubricant to nuts and a test of the lubricant efficiency are provided in Supplementary Requirement S1 of Specification **A563** and should be specified when required.

4.5 Zinc-coated bolts and nuts shall be shipped in the same container unless specifically requested otherwise by the purchaser.

NOTE 4—Research conducted on bolts of similar material and manufacture indicates that hydrogen-stress cracking or stress cracking corrosion may occur on hot-dip galvanized Grade BD bolts.

### 5. Chemical Composition

5.1 All fasteners shall be made from alloy steel conforming to the chemical composition requirements in accordance with **Table 1**. The steel shall contain sufficient alloying elements to qualify it as an alloy steel.

NOTE 5—Steel is considered to be alloy, by the American Iron and Steel Institute, when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 %; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

5.2 Product analysis may be made by the purchaser from finished material representing each lot of fasteners. The chemical composition thus determined shall conform to the requirements given in **Table 1**. Choice of alloy steel composition necessary to ensure meeting the specified mechanical requirements shall be made by the manufacturer and shall be reported to the purchaser for information purposes only.

5.3 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted.

5.4 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology **A751**.

### 6. Mechanical Properties

6.1 Fasteners shall not exceed the maximum hardness specified in **Table 2**. Fasteners less than three diameters in length

<sup>4</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.





TABLE 1 Chemical Requirements

Alloy Steel		
Element	Heat Analysis, %	Product Analysis, %
Carbon:		
For sizes through 1½ in.	0.30 to 0.53	0.28 to 0.55
For sizes larger than 1½ in.	0.35 to 0.53	0.33 to 0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Alloying Elements	A	A
Alloy Steel with Boron Addition		
Element	Heat Analysis, %	Product Analysis, %
Carbon:		
For sizes through 1½ in.	0.30-0.48	0.28-0.50
For sizes larger than 1½ in.	0.35-0.53	0.35-0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.040	0.045
Sulfur, max	0.040	0.045
Boron	0.0005-0.003	0.0005-0.003
Alloying Elements	A	A

<sup>A</sup>Steel, as defined by the American Iron and Steel Institute, shall be considered to be alloy when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: Manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 % or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

TABLE 2 Hardness Requirements for Full-Size Fasteners

Size, in.	Grade	Hardness			
		Brinell		Rockwell C	
		Minimum	Maximum	Minimum	Maximum
¼ to 2½	BC	255	331	26	36
Over 2½	BC	235	311	22	33
¼ to 2½	BD	311	363	33	39
Over 2½	BD	293	363	31	39

and studs less than four diameters in length shall have hardness values not less than the minimum nor more than the maximum hardness limits required in Table 2, as hardness is the only requirement.

6.2 Fasteners 1⅜ in. in diameter or less for Grade BC and 1¼ in. in diameter or less for Grade BD, other than those excepted in 6.1, shall be tested full size and shall conform to the tensile strength and either the proof load or the yield strength requirements in accordance with Table 3.

6.3 Fasteners larger than 1⅜ in. in diameter for Grade BC and fasteners larger than 1¼ in. in diameter for Grade BD, other than those excepted in 6.1, shall preferably be tested full size and when so tested, shall conform to the tensile strength and either the proof load or yield strength requirements in accordance with Table 3. When equipment of sufficient capacity for full-size testing is not available, or when the length of the fastener makes full-size testing impractical, machined specimens shall be tested and shall conform to the requirements in accordance with Table 4. In the event that fasteners

are tested by both full-size and by the machined test specimen methods, the full-size test shall govern if a controversy between the two methods exists.

6.4 For fasteners on which both hardness and tension tests are performed, acceptance based on tensile requirements shall take precedence in the event that there is controversy over low readings of hardness tests.

## 7. Dimensions

7.1 *Bolts*—Unless otherwise specified, the bolts shall be Hex Head with dimensions conforming to the latest issue of ASME B18.2.1.

7.2 *Studs*—Studs shall have dimensions conforming to those specified by the purchaser.

7.3 *Threads*:

7.3.1 Unless otherwise specified, threads shall be the Unified National Coarse Thread Series as specified in B1.1, and shall have Class 2 A tolerances.

7.3.2 When specified, threads shall be the Unified National Fine Thread Series, 8-Pitch Thread Series for sizes over 1 in. or 14-Pitch UNS on 1 in. size as specified in ANSI B1.1 and shall have Class 2A tolerances.

7.3.3 Unless otherwise specified, bolts and studs to be used with nuts or tapped holes that have been tapped oversize, in accordance with Specification A563, shall have Class 2A threads before hot dip or mechanically deposited zinc coating. After zinc coating, the maximum limit of pitch and major diameter may exceed the Class 2A limit by the following amount:

Diameter, in.	Oversize Limit, in. (mm) <sup>A</sup>
¼	0.016
⅝, ¾	0.017
7/16, ½	0.018
⅝ to ¾, incl	0.020
7/8	0.022
1.0 to 1¼, incl	0.024
1⅝, 1½	0.027
1¾ to 4.0, incl	0.050

<sup>A</sup> These values are the same as the overlapping required for zinc-coated nuts in Specification A563.

## 8. Workmanship

8.1 Surface discontinuity limits shall be in accordance with Specification F788/F788M.

## 9. Number of Tests

9.1 *Testing Responsibility*:

9.1.1 Each lot shall be tested by the manufacturer prior to shipment in accordance with the lot identification control quality assurance plan in 9.2 through 9.6.

9.1.2 When fasteners are furnished by a source other than the manufacturer, the responsible party as defined in 12.1 shall be responsible for ensuring that all tests have been performed and the fasteners comply with the requirements of this specification.

9.2 *Purpose of Lot Inspection*—The purpose of a lot inspection program is to ensure that each lot conforms to the requirements of this specification. For such a plan to be fully effective it is essential that secondary processors, distributors,





TABLE 3 Tensile Requirements for All Full-Size Fasteners—Inch-Pound Units

Bolt Size, in.	Threads per inch	Stress Area, <sup>A</sup> in. <sup>2</sup>	Grade BC			Grade BD		
			Tensile Strength, min, lbf <sup>B</sup>	Proof Load, min, lbf <sup>C</sup>	Yield Strength (0.2 % offset), min, lbf <sup>D</sup>	Tensile Strength, min, lbf <sup>E</sup>	Proof Load, min, lbf <sup>F</sup>	Yield Strength (0.2 % offset), min, lbf <sup>G</sup>
1	2	3	4	5	6	7	8	9
¼	20	0.0318	4 000	3 350	3 450	4 750	3 800	4 100
¼	28	0.0364	4 550	3 820	3 950	5 450	4 350	4 700
⅝	18	0.0524	6 550	5 500	5 700	7 850	6 300	6 800
⅝	24	0.0580	7 250	6 090	6 300	8 700	6 950	7 500
¾	16	0.0775	9 700	8 150	8 450	11 650	9 300	10 075
¾	24	0.0878	11 000	9 220	9 550	13 200	10 500	11 400
7/16	14	0.1063	13 300	11 150	11 600	15 950	12 750	13 850
7/16	20	0.1187	14 840	12 470	12 900	17 800	14 200	15 400
½	13	0.1419	17 750	14 900	15 450	21 300	17 050	18 500
½	20	0.1599	19 990	16 790	17 400	24 000	19 200	20 750
9/16	12	0.182	22 750	19 100	19 850	27 300	21 850	23 600
9/16	18	0.203	25 400	21 400	22 100	30 400	24 400	26 350
5/8	11	0.226	28 250	23 750	24 650	33 900	27 100	29 400
5/8	18	0.256	32 000	26 800	27 900	38 400	30 700	33 250
¾	10	0.334	41 750	35 050	36 400	50 100	40 100	43 400
¾	16	0.373	46 600	39 100	40 650	56 000	44 800	48 450
7/8	9	0.462	57 750	48 500	50 350	69 300	55 450	60 100
7/8	14	0.509	63 600	53 400	55 450	76 400	61 100	66 150
1	8	0.606	75 750	63 650	66 050	90 900	72 700	78 800
1	12	0.663	82 900	69 700	72 250	99 400	79 600	86 150
1	14 UNS	0.679	84 900	71 300	74 400	101 900	81 500	88 250
1 1/8	7	0.763	95 400	80 100	83 150	114 450	91 550	99 200
1 1/8	8	0.790	98 750	82 950	86 200	118 500	94 800	102 700
1 1/8	12	0.856	107 000	89 800	93 300	128 400	102 700	111 250
1 1/4	7	0.969	121 150	101 750	105 600	145 350	116 300	126 000
1 1/4	8	1.000	125 000	105 000	109 000	150 000	120 000	130 000
1 1/4	12	1.073	134 100	112 600	116 950	161 000	128 800	139 450
1 3/8	6	1.155	144 400	121 300	125 900	173 250	138 600	150 200
1 3/8	8	1.233	154 150	129 450	134 400	185 000	148 000	160 300
1 3/8	12	1.315	164 400	138 100	143 300	197 200	157 800	170 950
1 ½	6	1.405	175 650	147 550	153 150	210 750	168 600	182 500
1 ½	8	1.492	186 500	156 650	162 250	233 800	175 050	194 000
1 ½	12	1.581	197 600	166 000	172 300	237 200	189 700	205 500
1 ¾	5	1.90	237 500	199 500	207 100	285 000	228 000	247 000
1 ¾	8	2.08	260 000	218 400	226 700	312 000	249 600	270 000
2	4 ½	2.50	312 500	262 500	272 500	375 000	300 000	325 000
2	8	2.77	346 250	290 850	301 950	415 000	332 400	360 000
2 ¼	4 ½	3.25	406 250	341 250	354 250	487 000	390 000	422 500
2 ¼	8	3.56	445 000	373 800	388 050	534 000	422 200	462 800
2 ½	4	4.00	500 000	420 000	436 000	600 000	480 000	520 000
2 ½	8	4.44	550 000	466 200	483 950	666 000	532 800	577 200
2 ¾	4	4.93	566 950	468 350	488 050	690 200	517 650	566 950
2 ¾	8	5.43	624 450	515 850	537 550	750 200	570 150	624 450
3	4	5.97	686 550	567 150	591 050	835 800	626 850	686 550
3	8	6.51	748 650	618 450	644 500	911 400	683 550	748 650
3 ¼	4	7.10	816 500	674 500	702 900	994 000	745 500	816 500
3 ¼	8	7.69	884 350	730 550	761 300	1 076 600	807 650	884 350
3 ½	4	8.33	957 950	791 350	824 650	1 166 200	874 650	957 950
3 ½	8	8.96	1 030 400	851 200	887 050	1 254 400	940 800	1 030 400
3 ¾	4	9.66	1 110 900	917 700	956 350	1 352 400	1 014 300	1 110 900
3 ¾	8	10.34	1 199 100	983 300	1 023 650	1 447 600	1 085 700	1 189 100
4	4	11.08	1 274 200	1 052 600	1 096 900	1 551 200	1 163 400	1 274 200
4	8	11.81	1 358 200	1 122 000	1 169 200	1 653 400	1 240 050	1 358 150

<sup>A</sup> Stress Area, in.<sup>2</sup> = 0.7854 [ $D - 0.9743/\eta$ ]<sup>2</sup> where  $D$  = nominal diameter, in., and  $\eta$  = threads/in.

<sup>B</sup> Based on 125 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 115 000 psi for sizes over 2 ½ to 4 in., inclusive.

<sup>C</sup> Based on 105 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 95 000 psi for sizes over 2 ½ to 4 in., inclusive.

<sup>D</sup> Based on 109 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 99 000 psi for sizes over 2 ½ to 4 in., inclusive.

<sup>E</sup> Based on 150 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 140 000 psi for sizes over 2 ½ to 4 in., inclusive.

<sup>F</sup> Based on 120 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 105 000 psi for sizes over 2 ½ to 4 in., inclusive.

<sup>G</sup> Based on 130 000 psi for sizes ¼ to 2 ½ in., inclusive, and on 115 000 psi for sizes over 2 ½ to 4 in., inclusive.



TABLE 4 Mechanical Requirements for Machined Specimens

Grade	Size, in.	Tensile Strength min, psi	Yield Strength (0.2 % offset), min, psi	Elonga- tion in 2 in., min, %	Reduc- tion of Area, min, %
BC	¼ to 2½, incl	125 000	109 000	16	50
BC	Over 2½	115 000	99 000	16	45
BD	¼ to 2½, incl	150 000	130 000	14	40
BD	Over 2½	140 000	115 000	14	40

and purchasers maintain the identification and integrity of each lot until the product is installed.

**9.3 Lot Processing**—All fasteners shall be processed in accordance with a lot identification-control quality assurance plan. The manufacturer, secondary processors, and distributors shall identify and maintain the integrity of each lot of fasteners from raw-material selection through all processing operations and treatments to final packing and shipment. Each lot shall be assigned its own lot-identification number, each lot shall be tested, and the inspection test reports for each lot shall be retained.

**9.4 Lot Definition**—A lot is a quantity of a uniquely identified fastener product of the same nominal size and length produced consecutively at the initial operation from a single mill heat of material and heat treatment lot and processed at one time, by the same process, in the same manner so that statistical sampling is valid. The identity of the lot is maintained throughout all subsequent operations and packaging.

**9.5 Number of Tests**—The minimum number of tests from each production lot for the tests specified below shall be in accordance with Guide F1470.

Hardness  
Tensile

Coating Weight/Thickness  
Workmanship (Surface Disconti-  
nuities Section 8)

Proof Load

**9.5.1** The number of tests for dimensional and thread fit compliance shall be in accordance with the quality assurance provisions of the referenced dimensional standards.

**9.6** If any test specimen shows defective machining it may be discarded and another specimen substituted.

## 10. Test Methods

**10.1** Test methods shall be conducted in accordance with Test Methods F606.

**10.2** Proof load, rather than yield strength determination is preferred and shall be the arbitration method for fasteners 1¼ in. and under in diameter.

**10.3** Hexagon bolts shall be tested by the wedge tension method. Fracture shall be in the body or threads of the bolt without any fracture at the junction of the head and body.

**10.3.1** At the option of the manufacturer, the yield strength test (Method 2, Yield Strength paragraph of Test Methods F606) and the wedge tension test (Wedge Tension Testing of Full-Size Product paragraph, both from the Test Method section of Test Methods F606) may be accomplished concurrently to satisfy 10.2 and 10.3.

**10.4** Studs and bolts other than those in 10.3 shall be tested by the axial tension method.

**10.4.1** At the option of the manufacturer, the yield strength test and the axial tension test may be accomplished concurrently to satisfy 10.2 and 10.4.

**10.5** The speed of testing determined with a free running crosshead shall be a maximum of ⅛ in. (3.2 mm)/min for the bolt proof load (or yield strength) determination and a maximum of 1 in. (25.4 mm)/min for the tensile strength determination.

## 11. Inspection

**11.1** If the inspection described in 11.2 is required by the purchaser, it shall be specified in the inquiry and contract or purchase order.

**11.2** The inspector representing the purchaser shall have free entry to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspections required by the specification that are requested by the purchaser's representative shall be made before shipment, and shall be conducted as not to interfere unnecessarily with the operation of the works.

## 12. Responsibility

**12.1** The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser.

## 13. Rejection and Rehearing

**13.1** Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

## 14. Certification

**14.1** When specified on the purchase order, the manufacturer or supplier, whichever is the responsible party in accordance with Section 12, shall furnish the purchaser a test report which includes the following:

**14.1.1** Product description, grade, quantity, ASTM Specification Number and issue date,

**14.1.2** Alloy grade (AISI, SAE, UNS, etc.), heat analysis, and heat number, and type of quench,

**14.1.3** Results of hardness, tensile, and proof load tests, as applicable,

**14.1.4** Statement of compliance to Protective Coating Specification (if applicable),

**14.1.5** Statement of compliance with the surface discontinuity requirements of Specification F788/F788M,

**14.1.6** Statement of compliance dimensionally,

**14.1.7** Report, describe, or illustrate manufacturer's markings and their location,

**14.1.8** Lot number, purchase order number, and date shipped,

**14.1.9** Country of origin, and

**14.1.10** Title and signature of the individual assigned certification responsibility by the company officers, with complete mailing address.



14.2 Failure to include all the required information on the test report shall be cause for rejection.

## 15. Product Marking

15.1 *Manufacturers Identification*—All products shall be marked by the manufacturer with a unique identifier to identify the manufacturer or private label distributor, as appropriate.

### 15.2 *Grade Identification*:

15.2.1 All Grade BC products shall be marked “BC”.

15.2.2 All Grade BD products shall be marked “BD”. In addition to the “BD” marking, the product may be marked with 6 radial lines 60° apart if manufactured from alloy steel conforming to the requirements of this specification.

### 15.3 *Marking Location and Methods*:

15.3.1 Bolts shall be marked on the top of the bolt head.

15.3.2 Where studs have both coarse and fine threads, all markings shall appear on the coarse thread end or, if preferred, the manufacturer’s identification shall appear on the fine thread end and the grade marking on the coarse thread end.

15.3.3 Continuous thread studs may be marked on either end.

15.3.4 All markings may be raised or depressed at the manufacturer’s option.

15.3.5 Grade and manufacturer’s or private label distributor’s identification shall be separate and distinct. The two identifications shall preferably be in different locations and when on the same level shall be separated by at least two spaces.

## 16. Packaging and Package Marking

### 16.1 *Packaging*:

16.1.1 Unless otherwise specified, packaging shall be in accordance with Practice **D3951**.

16.1.2 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

### 16.2 *Package Marking*:

16.2.1 Each shipping unit shall include or be plainly marked with the following information:

16.2.1.1 ASTM designation and grade,

16.2.1.2 Size,

16.2.1.3 Name and brand or trademark of the manufacturer,

16.2.1.4 Number of pieces,

16.2.1.5 Purchase order number, and

16.2.1.6 Country of origin.

## 17. Keywords

17.1 alloy steel; bolts; steel; studs

## SUPPLEMENTARY REQUIREMENTS

### S1. Marking

S1.1 Studs that are continuously threaded with the same class of thread shall be marked on each end with the marking in accordance with Section **15**.

S1.2 Marking small sizes (customarily less than 0.375 in. (9.525 mm)) may not be practical. Consult the producer for the minimum size that can be marked.

## SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (A354-07a) that may impact the use of this standard. (Approved Dec. 15, 2011.)

(I) *Revised*—**Table 1**.

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# Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength<sup>1</sup>

This standard is issued under the fixed designation A490; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope\*

1.1 This specification covers two types of quenched and tempered, alloy steel, heavy hex structural bolts having a tensile strength of 150 to 173 ksi.

1.2 These bolts are intended for use in structural connections. These connections are covered under the requirements of the Specification for Structural Joints Using Specification A325 or A490 bolts, approved by the Research Council on Structural Connections; endorsed by the American Institute of Steel Construction and by the Industrial Fastener Institute.<sup>2</sup>

1.3 The bolts are furnished in sizes ½ to 1½ in., inclusive. They are designated by type denoting chemical composition as follows:

Type	Description
Type 1	Medium carbon alloy steel
Type 2	Withdrawn in 2002
Type 3	Weathering steel

1.4 This specification provides that heavy hex structural bolts shall be furnished unless other dimensional requirements are specified on the purchase order.

1.5 Terms used in this specification are defined in Terminology F1789 unless otherwise defined herein.

1.6 For metric bolts, see Specification A490M Classes 10.9 and 10.9.3

1.7 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 The following safety hazards caveat pertains only to the Test Methods portion, Section 12 of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Nuts, Rivets and Washers.

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<sup>2</sup> Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 700, Chicago, IL 60601-2001, <http://www.aisc.org>.

*of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

A194/A194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A354 Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

A490M Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)

A563 Specification for Carbon and Alloy Steel Nuts

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

D3951 Practice for Commercial Packaging

E384 Test Method for Knoop and Vickers Hardness of Materials

E709 Guide for Magnetic Particle Testing

E1444 Practice for Magnetic Particle Testing

F436 Specification for Hardened Steel Washers

F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

F788/F788M Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

F959 Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

F1136 Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners

F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard.



- F1789** Terminology for F16 Mechanical Fasteners  
**F2328** Test Method for Determining Decarburization and Carburization in Hardened and Tempered Threaded Steel Bolts, Screws and Studs  
**F2833** Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type  
**G101** Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels  
 2.2 *ASME Standards*.<sup>4</sup>  
**B1.1** Unified Screw Threads  
**B18.2.6** Fasteners for Use in Structural Applications  
**B18.24** Part Identification Number (PIN) Code System Standard for B18 Fastener Products  
 2.3 *IFI Standard*.<sup>5</sup>  
**IFI 144** Test Evaluation Procedures for Coating Qualification Intended for Use on High-Strength Bolts

### 3. Ordering Information

- 3.1 Orders for heavy hex structural bolts under this specification shall include the following:
- 3.1.1 Quantity (number of pieces of bolts and accessories);
  - 3.1.2 Size, including nominal bolt diameter, thread pitch, and bolt length. The thread length shall not be changed;
  - 3.1.3 Name of product: heavy hex structural bolts, or other such bolts as specified;
  - 3.1.4 Type of bolt (Type 1 or 3). When type is not specified, either Type 1 or Type 3 shall be furnished at the supplier's option;
  - 3.1.5 ASTM designation and year of issue,
  - 3.1.6 Other components such as nuts, washers, and washer-type direct tension indicators, if required;
  - 3.1.7 Test Reports, if required (see Section 15); and
  - 3.1.8 Protective coating per Specification **F1136**, Grade 3, if required. See 4.3.
  - 3.1.9 Protective coating per Specification **F2833**, Grade 1, if required. See 4.3.
  - 3.1.10 Special requirements.
  - 3.1.11 For establishment of a part identifying system, see ASME **B18.24**.

NOTE 1—A typical ordering description follows: 1000 pieces 1–8 in. dia × 4 in. long heavy hex structural bolt, Type 1, *ASTM A490 – 02*; each with two hardened washers, ASTM **F436** Type 1; and one heavy hex nut, ASTM **A563** Grade DH.

#### 3.2 Recommended Nuts:

3.2.1 Nuts conforming to the requirements of Specification **A563** are the recommended nuts for use with Specification A490 heavy hex structural bolts. The nuts shall be of the class and have a surface finish for each type of bolt as follows:

Bolt Type and Finish	Nut Class and Finish
1, plain (uncoated)	<b>A563</b> —DH, DH3 plain (uncoated)

1, coated in accordance with Specification **F1136**, Grade 3 or Specification **F2833**, Grade 1.

**A563**—coated in accordance with Specification **F1136**, Grade 5 or Specification **F2833**, Grade 1.

3, weathering steel

**A563**—DH3, weathering steel

3.2.2 Alternatively, nuts conforming to Specification **A194/A194M** Gr. 2H plain (uncoated) are considered a suitable substitute for use with Specification A490 Type 1 heavy hex structural bolts.

3.3 *Recommended Washers*—Washers conforming to Specification **F436** are the recommended washers for use with Specification A490 heavy hex structural bolts. The washers shall have a surface finish for each type of bolt as follows:

Bolt Type and Finish	Washer Finish
1, plain (uncoated)	plain (uncoated)
1, coated in accordance with <b>F1136</b> , Grade 3 or <b>F2833</b> , Grade 1.	plain, coated in accordance with <b>F1136</b> , Grade 3 or <b>F2833</b> , Grade 1.
3, weathering steel	weathering steel

3.4 *Other Accessories*—When compressible washer type direct tension indicators are specified to be used with these bolts, they shall conform to Specification **F959** Type 490.

### 4. Materials and Manufacture

4.1 *Heat Treatment*—Type 1 and Type 3 bolts shall be heat treated by quenching in oil from the austenitic temperature and then tempered by reheating to a temperature of not less than 800°F.

4.2 *Threading*—The threads shall be cut or rolled.

4.3 *Protective Coatings*:

4.3.1 When a protective coating is required and specified, the bolts shall be coated with Zinc/Aluminum Corrosion Protective Coatings in accordance with Specification **F1136**, Grade 3 or Specification **F2833**, Grade 1. These coatings have been qualified based on the findings of an investigation founded on **IFI 144**.<sup>6</sup>

4.3.2 No other metallic coatings are permitted unless authorized by Committee F16. Future consideration of any coating will be based on results of testing performed in accordance with the procedures in **IFI 144**, and submitted to Committee F16 for review (See note 2).

NOTE 2—For more detail see the H. E. Townsend Report “Effects of Zinc Coatings on Stress Corrosion Cracking and Hydrogen Embrittlement of Low Alloy Steel,” published in Metallurgical Transactions, Vol. 6, April 1975.

### 5. Chemical Composition

5.1 Type 1 bolts shall be alloy steel conforming to the chemical composition specified in Table 1. The steel shall contain sufficient alloying elements to qualify it as an alloy steel (see Table 1, footnote A.).

5.2 Type 3 bolts shall be weathering steel conforming to the chemical composition requirements in Table 2. See Guide **G101** for methods of estimating the atmospheric corrosion resistance of low alloy steel.

<sup>4</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>5</sup> Available from Industrial Fastener Institute, (IFI), 6363 Oak Tree Boulevard, Independence, OH 44131. <http://www.industrial-fasteners.org>.

<sup>6</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F16-1001.



**TABLE 1 Chemical Requirements for Type 1 Bolts**

Alloy Steel		
Element	Heat Analysis, %	Product Analysis, %
Carbon		
For sizes through 1½ in.	0.30–0.48	0.28–0.50
For size 1½ in.	0.35–0.53	0.33–0.55
Phosphorus, max	0.040	0.045
Manganese, min	0.60	0.57
Sulfur, max	0.040	0.045
Alloying Elements	<sup>A</sup>	<sup>A</sup>
Alloy Steel with Boron Addition		
Element	Heat Analysis, %	Product Analysis, %
Carbon		
For sizes through 1½ in.	0.30–0.48	0.28–0.50
For size 1½ in.	0.35–0.53	0.35–0.55
Manganese, min	0.60	0.57
Phosphorus, max	0.040	0.045
Sulfur, max	0.040	0.045
Boron	0.0005–0.003	0.0005–0.003
Alloying Elements	<sup>A</sup>	<sup>A</sup>

<sup>A</sup>Steel, as defined by the American Iron and Steel Institute, shall be considered to be alloy when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: Manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 % or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

**TABLE 2 Chemical Requirements for Type 3 Bolts**

Element	Heat Analysis, %	Product Analysis, %
Carbon		
Sizes 0.75 in. and smaller	0.20–0.53	0.19–0.55
Sizes larger than 0.75 in.	0.30–0.53	0.28–0.55
Manganese, min	0.40	0.37
Phosphorus, max	0.035	0.040
Sulfur, max	0.040	0.045
Copper	0.20–0.60	0.17–0.63
Chromium, min	0.45	0.42
Nickel, min	0.20	0.17
or		
Molybdenum, min	0.15	0.14

5.3 Product analyses made on finished bolts representing each lot shall conform to the product analysis requirements specified in **Tables 1 and 2**, as applicable.

5.4 Heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be used for bolts furnished to this specification. Compliance with this requirement shall be based on certification that steels having these elements intentionally added were not used.

5.5 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology **A751**.

## 6. Mechanical Properties

6.1 *Hardness*—The bolts shall conform to the hardness specified in **Table 3**.

6.2 *Tensile Properties*:

6.2.1 Except as permitted in **6.2.1.1** for long bolts and **6.2.1.2** for short bolts, sizes 1.00 in. and smaller having a nominal length of  $2\frac{1}{4}D$  and longer and sizes larger than 1.00 in. having a nominal length of  $3D$  and longer shall be wedge tested full size and shall conform to the minimum and maximum wedge tensile load, and proof load or alternative proof load specified in **Table 4**. The load achieved during proof load testing shall be equal to or greater than the specified proof load.

6.2.1.1 When the length of the bolt makes full-size testing impractical, machined specimens shall be tested and shall conform to the requirements specified in **Table 5**. When bolts are tested by both full-size and machined specimen methods, the full-size test shall take precedence.

6.2.1.2 Sizes 1.00 in. and smaller having a nominal length shorter than  $2\frac{1}{4}D$  down to  $2D$ , inclusive, that cannot be wedge tensile tested shall be axially tension tested full size and shall conform to the minimum tensile load and proof load or alternate proof load specified in **Table 4**. Sizes 1.00 in. and smaller having a nominal length shorter than  $2D$  and sizes larger than 1.00 in. with nominal lengths shorter than  $3D$  that cannot be axially tensile tested shall be qualified on the basis of hardness.

6.2.2 For bolts on which hardness and tension tests are performed, acceptance based on tensile requirements shall take precedence in the event of low hardness readings.

## 7. Carburization/Decarburization

7.1 This test is intended to evaluate the presence or absence of carburization and decarburization as determined by the difference in microhardness near the surface and core.

7.2 *Requirements*:

7.2.1 *Carburization*—The bolts shall show no evidence of a carburized surface when evaluated in accordance with **12.2**.

7.2.2 *Decarburization*—Hardness value differences shall not exceed the requirements set forth for decarburization in Test Method **F2328** materials when evaluated in accordance with **12.2**.

## 8. Dimensions

8.1 *Head and Body*:

**TABLE 3 Hardness Requirements for Bolts  
½ to 1½ in. Nominal Size**

Size, in.	Nominal Length, in.	Brinell		Rockwell C	
		min	max	min	max
½ to 1, incl.	Less than $2D$	311	352	33	38
	$2D$ and longer	...	352	...	38
Over 1 to 1½, incl.	Less than $3D$	311	352	33	38
	$3D$ and longer	...	352	...	38

**TABLE 4 Tensile Load Requirements for Bolts Tested Full-Size**

Bolt Size, Threads per Inch, and Series Designation	Stress Area, <sup>A</sup> in. <sup>2</sup>	Tensile Load, <sup>B</sup> lbf		Proof Load, <sup>B</sup> lbf	Alternative Proof Load, <sup>B</sup> lbf
		min	max	Length Measurement Method	Yield Strength Method
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
½-13 UNC	0.142	21 300	24 600	17 050	18 500
⅝-11 UNC	0.226	33 900	39 100	27 100	29 400
¾-10 UNC	0.334	50 100	57 800	40 100	43 400
⅞-9 UNC	0.462	69 300	79 950	55 450	60 100
1-8 UNC	0.606	90 900	104 850	72 700	78 800
1⅛-7 UNC	0.763	114 450	132 000	91 550	99 200
1¼-7 UNC	0.969	145 350	167 650	116 300	126 000
1⅝-6 UNC	1.155	173 250	199 850	138 600	150 200
1⅞-6 UNC	1.405	210 750	243 100	168 600	182 600

<sup>A</sup> The stress area is calculated as follows:

$$A_s = 0.7854 [D - (0.9743/n)]^2$$

where:

$A_s$  = stress area, in.<sup>2</sup>  
 $D$  = nominal bolt size, and  
 $n$  = threads per inch.

<sup>B</sup> Loads tabulated and loads to be used for tests of full-size bolts larger than 1½ in. in diameter are based on the following:

Bolt Size	Column 3	Column 4	Column 5	Column 6
½ to 1½ in., incl	150 000 psi	173 000 psi	120 000 psi	130 000 psi

**TABLE 5 Tensile Strength Requirements for Specimens Machined from Bolts**

Bolt Size, in.	Tensile Strength, psi		Yield Strength (0.2 % offset), min, psi	Elongation in 2 in. or 50 mm, min, %	Reduction of Area, min, %
	min	max			
½ to 1½ in., incl	150 000	173 000	130 000	14	40

8.1.1 Unless otherwise specified, bolts shall conform to the dimensions for heavy hex structural bolts specified in ASME B18.2.6.

8.1.2 The thread length shall not be changed from that specified in ASME B18.2.6 for heavy hex structural bolts. Bolts requiring thread lengths other than those required by this specification shall be ordered under Specification A354 Gr. BD.

8.2 *Threads*—Threads shall be the Unified Coarse Thread Series as specified in ASME B1.1 and shall have Class 2A tolerances.

## 9. Workmanship

9.1 The allowable limits, inspection, and evaluation of the surface discontinuities, quench cracks, forging cracks, head bursts, shear bursts, seams, folds, thread laps, voids, tool marks, nicks, and gouges shall be in accordance with Specification F788/F788M.

## 10. Magnetic Particle Inspection for Longitudinal Discontinuities and Transverse Cracks

### 10.1 Requirements:

10.1.1 Each sample representative of the lot shall be magnetic particle inspected for longitudinal discontinuities and transverse cracks.

10.1.2 The lot, as represented by the sample, shall be free from nonconforming bolts, as defined in Specification F788/F788M, when inspected in accordance with 10.2.1-10.2.3.

### 10.2 Inspection Procedure:

10.2.1 The inspection sample shall be selected at random from each lot in accordance with Practice F1470 and examined for longitudinal discontinuities and transverse cracks.

10.2.2 Magnetic particle inspection shall be conducted in accordance with Guide E709 or Practice E1444. Guide E709 shall be used for referee purposes. If any nonconforming bolt is found during the manufacturer's examination of the lot selected in 10.2.1, the lot shall be 100 % magnetic particle inspected, and all nonconforming bolts shall be removed and scrapped or destroyed.

10.2.3 Eddy current or liquid penetrant inspection shall be an acceptable substitute for the 100 % magnetic particle inspection when nonconforming bolts are found and 100 % inspection is required. On completion of the eddy current or liquid penetrant inspection, a random sample selected from each lot in accordance with Practice F1470 shall be re-examined by the magnetic particle method. In case of controversy, the magnetic particle test shall take precedence.

10.2.4 Magnetic particle indications of themselves shall not be cause for rejection. If in the opinion of the quality assurance



representative the indications may be cause for rejection, a sample taken in accordance with Practice **F1470** shall be examined by microscopic examination or removal by surface grinding to determine if the indicated discontinuities are within the specified limits.

## 11. Number of Tests and Retests

### 11.1 *Testing Responsibility:*

11.1.1 Each lot shall be tested by the manufacturer prior to shipment in accordance with the lot identification control quality assurance plan in **11.2-11.5**.

11.1.2 When bolts are furnished by a source other than the manufacturer, the Responsible Party as defined in **16.1** shall be responsible for assuring all tests have been performed and the bolts comply with the requirements of this specification.

11.2 *Purpose of Lot Inspection*—The purpose of a lot inspection program shall be to ensure that each lot as represented by the samples tested conforms to the requirements of this specification. For such a plan to be fully effective, it is essential that secondary processors, distributors, and purchasers maintain the identification and integrity of each lot until the product is installed.

11.3 *Lot Method*—All bolts shall be processed in accordance with a lot identification-control quality assurance plan. The manufacturer, secondary processors, and distributors shall identify and maintain the integrity of each lot of bolts from raw-material selection through all processing operations and treatments to final packing and shipment. Each lot shall be assigned its own lot-identification number, each lot shall be tested, and the inspection test reports for each lot shall be retained.

11.4 *Lot Definition*—A lot shall be a quantity of uniquely identified heavy hex structural bolts of the same nominal size and length produced consecutively at the initial operation from a single mill heat of material and processed at one time, by the same process, in the same manner, so that statistical sampling is valid. The identity of the lot and lot integrity shall be maintained throughout all subsequent operations and packaging.

### 11.5 *Number of Tests:*

11.5.1 The minimum number of tests from each lot for the tests specified below shall be as follows:

Tests	Number of Tests in Accordance with
Hardness, tensile strength, proof load	Practice <b>F1470</b>
Surface discontinuities	Specification <b>F788/F789M</b>
Magnetic particle inspection	Specification <b>F788/F789M</b>
Dimensions and thread fit	ASME <b>B18.2.6</b>

11.5.2 For carburization and decarburization tests, not less than one sample unit per manufactured lot shall be tested for microhardness.

## 12. Test Methods

### 12.1 *Tensile, Proof Load, and Hardness:*

12.1.1 Tensile, proof load, and hardness tests shall be conducted in accordance with Test Methods **F606**.

12.1.2 Tensile strength shall be determined using the Wedge or Axial Tension Testing Method of Full Size Product Method or the Machined Test Specimens Method, depending on size and nominal length as specified in **6.2.1-6.2.2**. Fracture on

full-size tests shall be in the body or threads of the bolt without a fracture at the junction of the head and body.

12.1.3 Proof load shall be determined using Method 1, Length Measurement, or Method 2, Yield Strength, at the option of the manufacturer.

12.2 *Carburization/Decarburization*—Tests shall be conducted in accordance with Test Method **F2328** Hardness Method.

12.3 *Microhardness*—Tests shall be conducted in accordance with Test Method **E384**.

12.4 *Magnetic Particle*—Inspection shall be conducted in accordance with Section **10**.

## 13. Inspection

13.1 If the inspection described in **13.2** is required by the purchaser, it shall be specified in the inquiry and contract or order.

13.2 The purchaser's representative shall have free entry to all parts of manufacturer's works or supplier's place of business that concern the manufacture of the material ordered. The manufacturer or supplier shall afford the purchaser's representative all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspections required by the specification that are requested by the purchaser's representative shall be made before shipment, and shall be conducted as not to interfere unnecessarily with the operation of the manufacturer's works or supplier's place of business.

## 14. Rejection and Rehearing

14.1 Disposition of nonconforming material shall be in accordance with Practice **F1470** section titled "Disposition of Nonconforming Lots."

## 15. Certification

15.1 When specified on the purchase order, the manufacturer or supplier, whichever is the responsible party as defined in Section **16** shall furnish the purchaser a test report that includes the following:

15.1.1 Heat analysis, heat number, and a statement certifying that heats having bismuth, selenium, tellurium, or lead intentionally added were not used to produce the bolts;

15.1.2 Results of hardness, tensile, and proof load tests;

15.1.3 Results of magnetic particle inspection for longitudinal discontinuities and transverse cracks;

15.1.4 Results of tests and inspections for surface discontinuities including visual inspection for head bursts;

15.1.5 Results of carburization and decarburization tests;

15.1.6 Statement of compliance with dimensional and thread fit requirements;

15.1.7 Lot number and purchase order number;

15.1.8 Complete mailing address of responsible party; and

15.1.9 Title and signature of the individual assigned certification responsibility by the company officers.

15.2 Failure to include all the required information on the test report shall be cause for rejection.



## 16. Responsibility

16.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser.

## 17. Product Marking

17.1 *Manufacturer's Identification*—All Type 1 and Type 3 bolts shall be marked by the manufacturer with a unique identifier to identify the manufacturer or private label distributor, as appropriate.

### 17.2 *Grade Identification:*

17.2.1 Type 1 bolts shall be marked “A490.”

17.2.2 Type 3 bolts shall be marked “A490” underlined.

17.3 *Marking Location and Methods*—All marking shall be located on the top of the bolt head and shall be either raised or depressed at the manufacturer's option.

17.4 *Acceptance Criteria*—Bolts that are not marked in accordance with these provisions shall be considered nonconforming and subject to rejection.

17.5 Type and manufacturer's or private label distributor's identification shall be separate and distinct. The two identifi-

cations shall preferably be in different locations and, when on the same level, shall be separated by at least two spaces.

## 18. Packaging and Package Marking

### 18.1 *Packaging:*

18.1.1 Unless otherwise specified, packaging shall be in accordance with Practice **D3951**.

18.1.2 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

### 18.2 *Package Marking:*

18.2.1 Each shipping unit shall include or be plainly marked with the following information:

18.2.1.1 ASTM designation and type,

18.2.1.2 Size,

18.2.1.3 Name and brand or trademark of the manufacturer,

18.2.1.4 Number of pieces,

18.2.1.5 Lot number,

18.2.1.6 Purchase order number, and

18.2.1.7 Country of origin.

## 19. Keywords

19.1 bolts; alloy steel; steel; structural; weathering steel

## SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (A490–11) that may impact the use of this standard. (Approved April 1, 2012.)

(1) *Revised*—Section **2** to include protective coating **F2833** grade 1.

(2) *Revised*—**3.1** to include protective coating **F2833** grade 1.

(3) *Revised*—**3.2.1** to include protective coating **F2833** grade 1.

(4) *Revised*—**3.3** to include protective coating **F2833** grade 1.

(5) *Revised*—**4.3.1** to include protective coating **F2833** grade 1.

Committee F16 has identified the location of selected changes to this standard since the last issue (A490–10a<sup>e1</sup>) that may impact the use of this standard. (Approved Dec. 15, 2011.)

(1) *Revised*—**Table 1**.

Committee F16 has identified the location of selected changes to this standard since the last issue (A490–10) that may impact the use of this standard. (Approved Dec. 1, 2010.)

(1) *Revised*—In **Table 3**, reduced maximum Rockwell C hardness from 39 to 38 HRC

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