

LIGO VACUUM EQUIPMENT

LOUISIANA SITE INSTALLATION & ALIGNMENT DOCUMENTATION

CONTRACT NO: PC 175730
PSI DOCUMENT NO: V049-1-191
PROGRAM I.D.: LIGO VACUUM EQUIPMENT
CDRL NO: NONE
APPROVAL STATUS: A

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581

LIGO-C990033-00-V

CALIFORNIA INSTITUTE OF TECHNOLOGY  **LIGO PROJECT**
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

**LIGO VACUUM EQUIPMENT
LOUISIANA SITE
INSTALLATION & ALIGNMENT
DOCUMENTATION
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SECTION

1.0 CORNER STATION

2.0 RIGHT END STATION

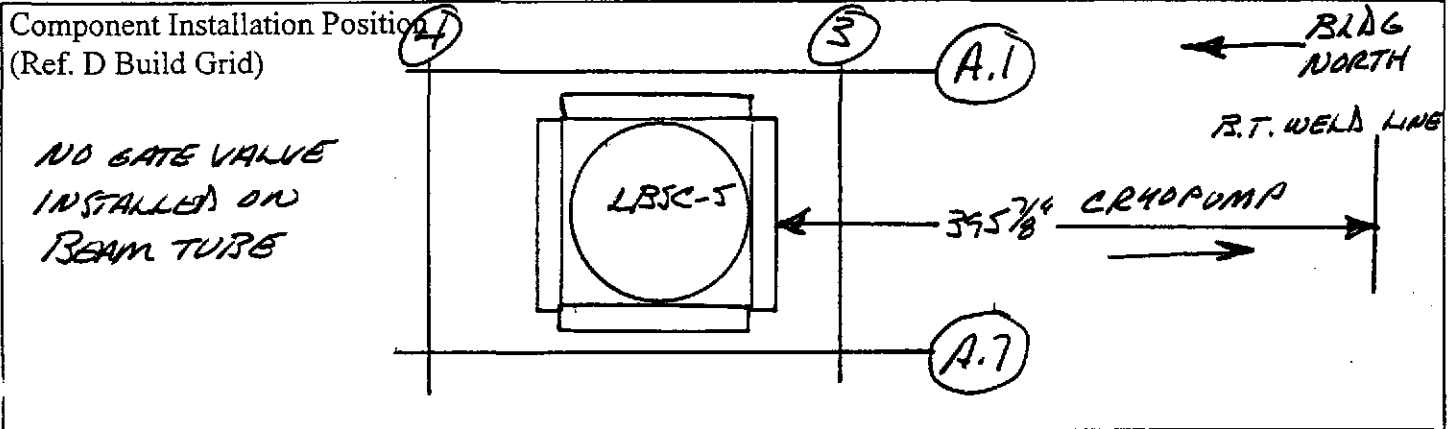
3.0 LEFT END STATION

4.0 GROUT TEST REPORTS

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBJK-5
 Component Name BEAM SPLITTER, LEFT END STA.
 Component S/N S/N 15
 Component Installation Weight (lb.) 20 000 #

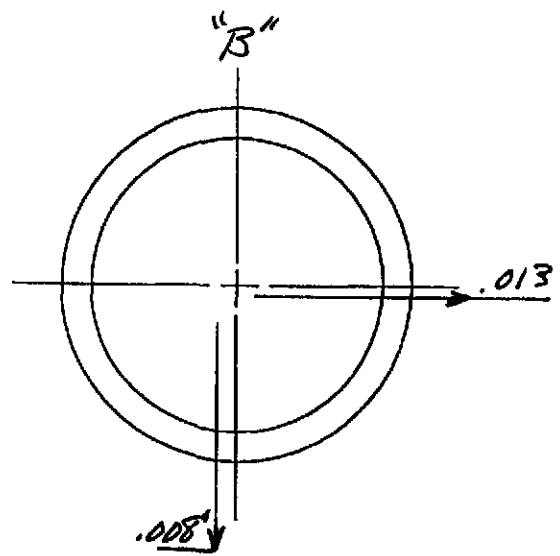
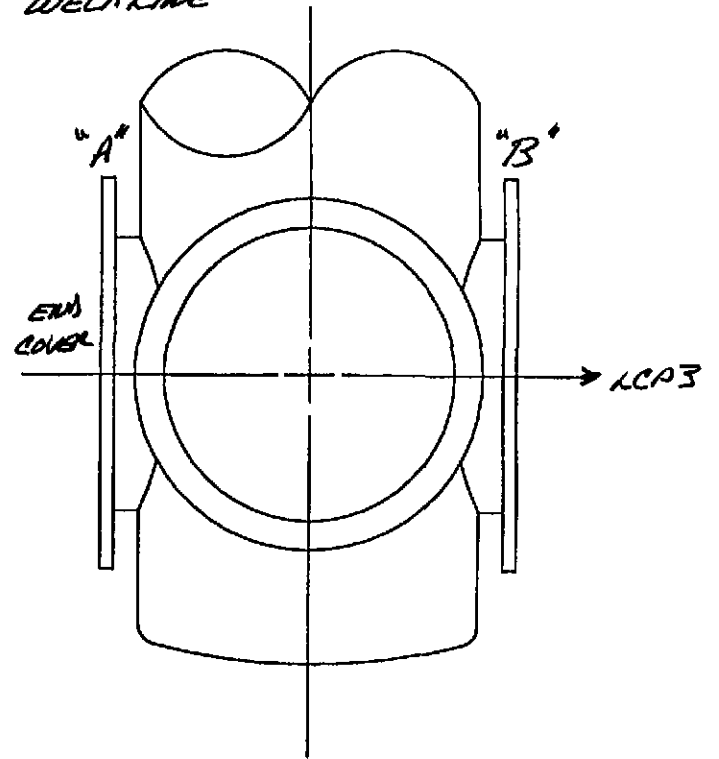
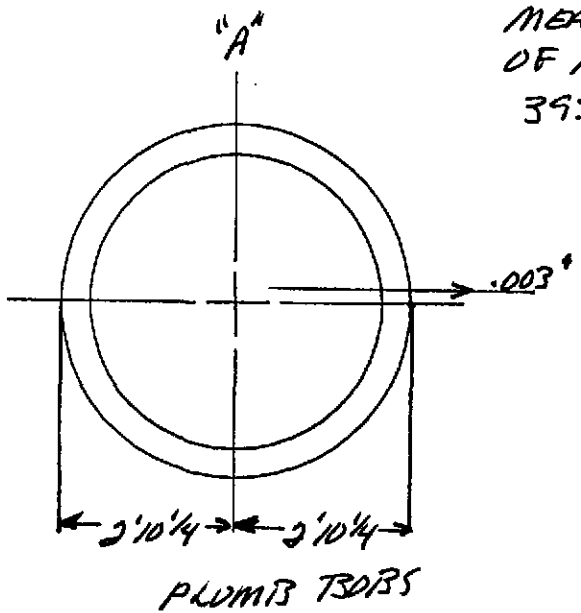


Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	JSS	23 MAY 98
2. Component Located For Anchor Bolt Marking	JSS	23 MAY 98
	Buyer DWE	23 MAY 98
3. Final Component Location Complete	JSS	27 MAY 98
	Buyer DWE	27 MAY 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

BLAG
NORTH
←

MEASUREMENT FROM THE SOUTH FACE
OF LBSC5 TO THE BEAM TUBE WELD LINE
 $395 \frac{7}{8}''$



Component ID: LBSC 5
Serial No.: 5/10 '15

NO TILT INDICATED

(TRM 6'0.87)

Title:	BEAM SPLITTER INSTALLED POSITION	Job No.:	V59049
Project:	LIGO Equipment Set	Scale:	None
		Dwn By:	

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-009	Rev. 2	Date: 23 MAY 98	
Item Anchored: BEAM SPLITTER 5	No. of Anchors: 16	Size: 1"	Type: HAS-SUPER

Attribute	a. Installer	b. Accepted	c. DATE	d. N/A
Anchor Type (HAS Str or Super)	TDS	NUS	23 MAY 98	
Spacing & Location	TDS	NUS	↓	
Anchor Size & Length 1x1 5/8" x 1 5/8"	TDS	NUS		
Hole Size 1 1/8"	TDS	NUS		
Hole & Core Condition (no voids, etc.)	TDS	NUS		
Embedment (minus 0 plus 1/8") 1 5/8" / 1 5/8"	TDS	NUS		
Angle (90 deg. + 1 deg.)	TDS	NUS		
Floor Scarified	TDS	NUS		
Proper Nut Engagement	TDS	NUS		
Tightening	TDS NUS	NUS		17 AUG 98
Torque Device Identification: AP-9 400 FT. LBS.				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: NUS	Date: 23 MAY 98
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COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBSC-5

Component Name: BEAM SPLITTER LEFT END STA.

Component S/N: S/N 15

Vacuum Sealing Surfaces Inspection

By: JTS 7-24-98

Buyer: JSE 24 JUL 98

Cleanliness Inspection

By: JTS 7-24-98

Buyer: JSE 24 JUL 98

O-Rings Installed

By: JTS 7-24-98

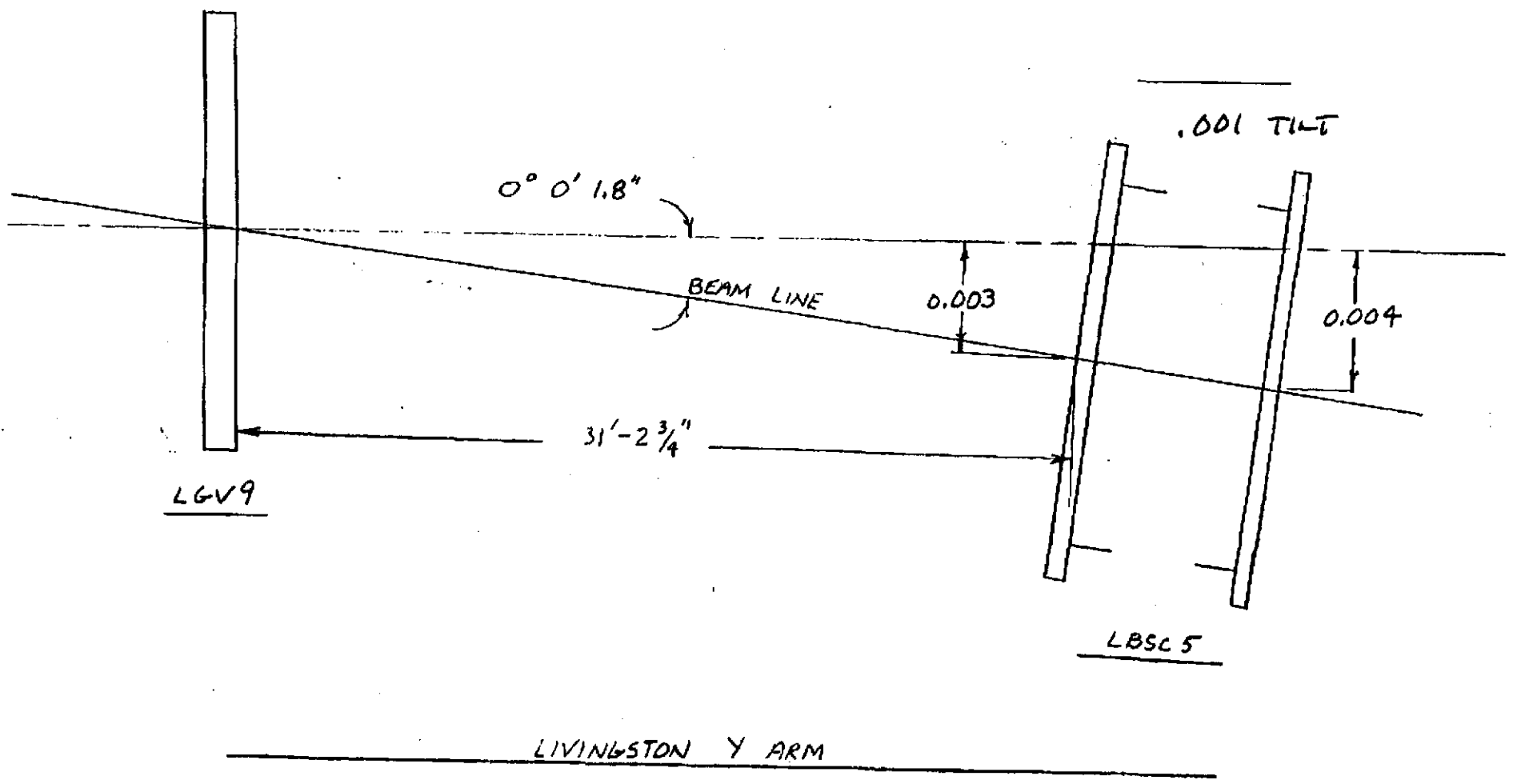
Buyer: JSE 24 JUL 98

Bolt Torque

By: JTS 8-3-98

Comments:

Rework Required:



SPLIT DIFFERENCE FROM
UPPER FLANGE

TUESDAY - WED 2-27-98

DATE 2/26/98 REFT END ST.

PAGE # 71

FINAL SET BSC-5
CRYOPUMP END:

.008 EAST OF ϕ

DUAL BOBS OTHER END:
 $2' 2 \frac{5}{16}'' \pm .015''$

ELEV CRYOPUMP END:

.013" High

OTHER END:

.003 Low.

G.C. DAVE EVERS
ALLEN SIEBLY

LEFT END STATION IS
 2 PARALLEL TO BEAM LINE,
 SO NO ELEVATION OR
 TILT ON ANY COMPONENTS
 WAS USED.

SATURDAY

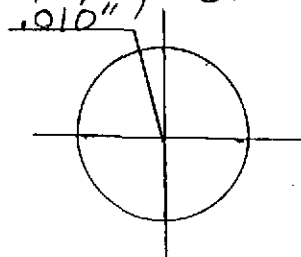
DATE 5/23/90

LEFT END ST.

PAGE # 70

PRE BOLT ON BSC-5

CRYO PUMP END ϕ :



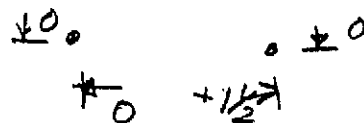
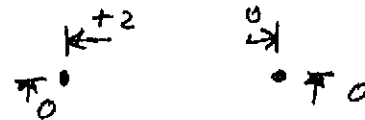
.010 EAST OF ϕ

DUAL BOBS ON SOUTH
 END:

$2 \frac{5}{16} \pm .015$

END $\pm \frac{1}{16}$

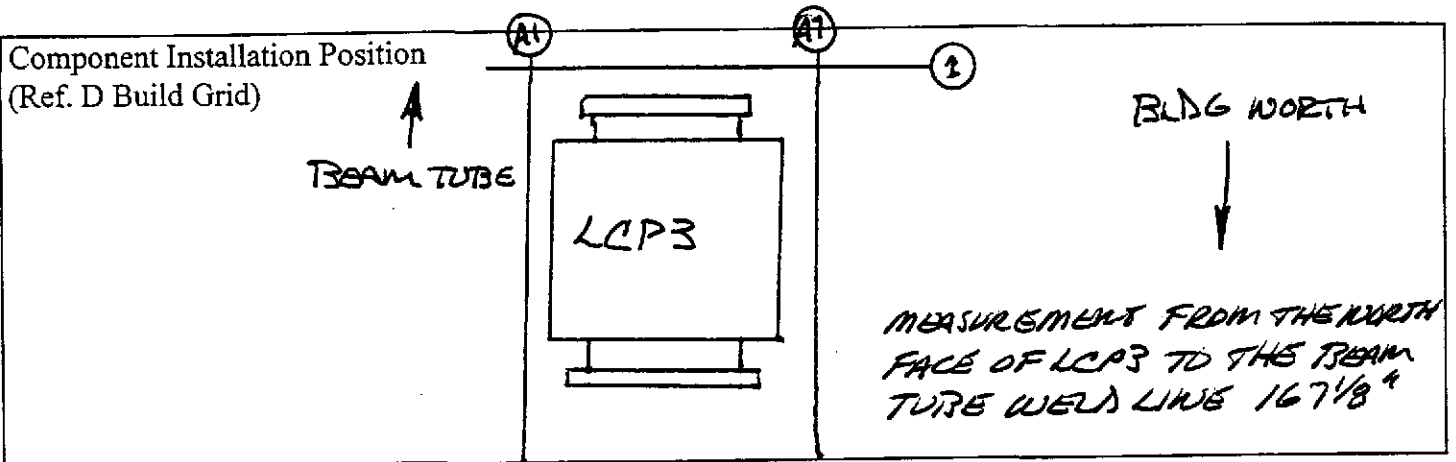
PLUMBED WITH STARRET 90



Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LCP3 / BE-4D
 Component Name CRYO PUMP, LEFT END STATION
 Component S/N S/N 04 / 12
 Component Installation Weight (lb.) 9000# w/BE-4 SPOOL

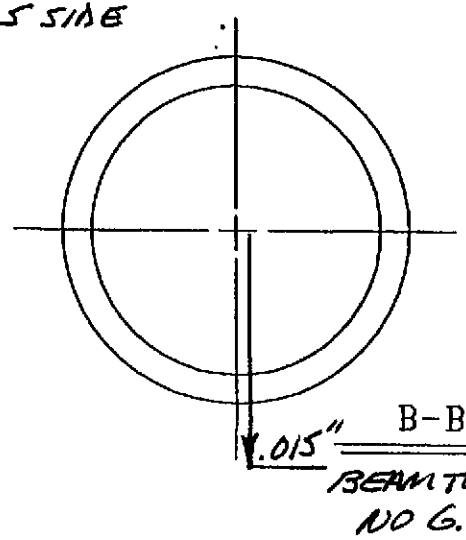
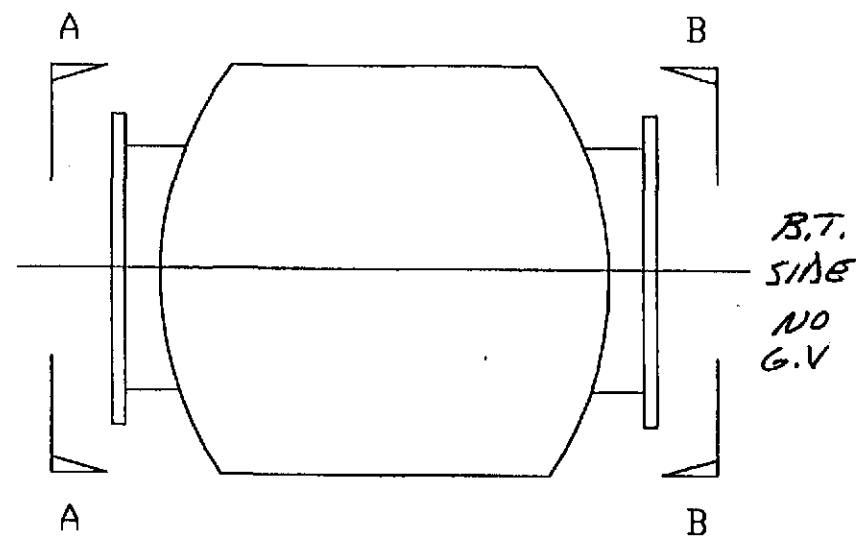
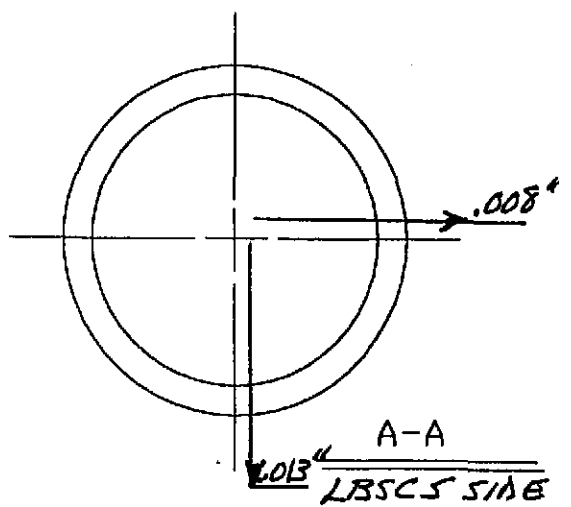


Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>JTS</i>	20 MAY 98
2. Component Located For Anchor Bolt Marking	<i>JTS</i>	21 MAY 98
	Buyer <i>JMS</i>	21 MAY 98
3. Final Component Location Complete	<i>JTS</i>	22 MAY 98
	Buyer <i>JMS</i>	22 MAY 98

SPECIFICATION

Number: A V049-2-174 Rev. 2

BLDG NORTH



• MEASUREMENT FROM NORTH FACE OF LCP3 TO THE BEAM TUBE WELLS LINE 167 1/8"
 • PER DRAWG V049-B-009 167 1/8"

Component ID: LCP3 / LBETHD
 Serial No.: 5/10 04 / 12

	①	②	△
Calc			
Shot			

SLOPE .016"/FT
 BEAM LINE ELEV. 6'0 3/16"
 NO BEAM TUBE GATE VALVE INSTALLED

Title: CRYO PUMP INSTALLED POSITION	Job No.:
Project: LIGO Equipment Set	Scale: None Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-009	Rev.: 2	Date: 31 MAY 98	
Item Anchored: LCP3	No. of Anchors: 16	Size: 1"	Type: HAS-SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or <u>Super</u>)	TSS	<input checked="" type="checkbox"/> YES		31 MAY 98
Spacing & Location	TSS	<input checked="" type="checkbox"/> YES		↓
Anchor Size & Length 1" x 1 9/16"	TSS	<input checked="" type="checkbox"/> YES		
Hole Size 1 1/8"	TSS	<input checked="" type="checkbox"/> YES		
Hole & Core Condition (no voids, etc.)	TSS	<input checked="" type="checkbox"/> YES		
Embedment (minus 0 plus 1/8")	TSS	<input checked="" type="checkbox"/> YES		
Angle (90 deg. + 1 deg.)	TSS	<input checked="" type="checkbox"/> YES		
Floor Scarified	TSS	<input checked="" type="checkbox"/> YES		
Proper Nut Engagement	TSS	<input checked="" type="checkbox"/> YES		↓
Tightening	TSS	<input checked="" type="checkbox"/> YES		17 AUG 98
Torque Device Identification: AP-9 400 FT. LBS.				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <u>NCS</u>	Date: 31 MAY 98
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COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LCP3 / BE-40

Component Name:

CR40 PUMP, LEFT END STATION

Component S/N:

S/N 04 / 12

Vacuum Sealing Surfaces Inspection

By:

JTS 21 MAY 98

Buyer:

MS 31 MAY 98

Cleanliness Inspection

By:

JTS 21 MAY 98

Buyer:

MS 31 MAY 98

O-Rings Installed

By:

JTS 21 MAY 98

Buyer:

MS 31 MAY 98

Bolt Torque

By:

JTS 8-3-98

Comments:

Rework Required:

Wednesday

DATE 5/20/18

LEFT END ST

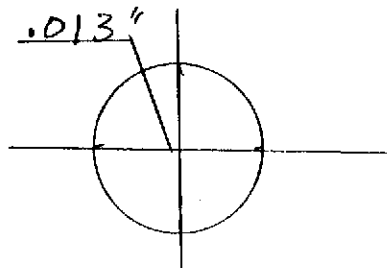
PAGE # 70

PRE BOLT SET ON CP-3

LEGS PLUMB

BSC- END .013" EAST OF

⊕ .013"



DUAL BOB $2'2\frac{3}{16}"$ EACH WAY
FROM ⊕

FROM MONUMENT ON TERMIN.
SLAB $13'11\frac{1}{8}"$ TO BSC
FACE OF FLANGE

CLOCKING WITH STRAIGHT
EDGE & 2' LEVEL SHOWS
0.00

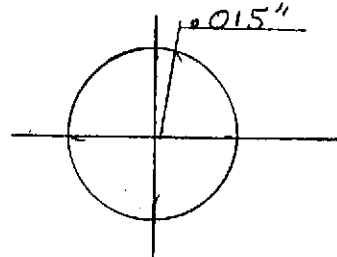
THURS

DATE 5/21/88 LEFT END ST. PAGE # 91

LCP-3 FINAL SET

BSC. END ϕ IS:

.015" WEST OF ϕ



DUAL BOBS:

2' 2 $\frac{3}{16}$ " \pm .015 EACH WAY

ENDS:

$\frac{3}{16}$ " LONG FROM MONUMENT

Q.C. DAVE EVERS

ELEV:

B.S. END .008" HIGH

OPPOSITE END:

.007" HIGH
(OVER)

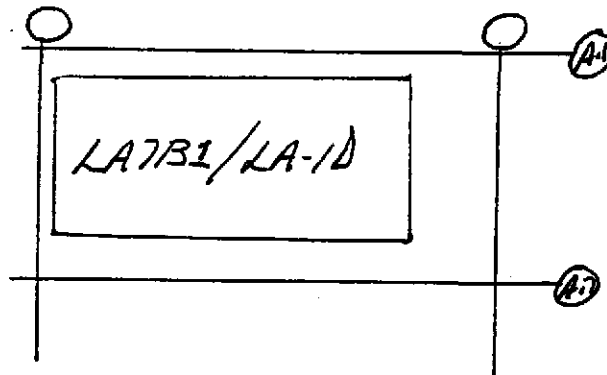
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA7B1 / LA-1D
 Component Name LEFT END STATION SPOOL
 Component S/N S/N 03 / S/N 10
 Component Installation Weight (lb.) 6500#

Component Installation Position
 (Ref. D Build Grid)

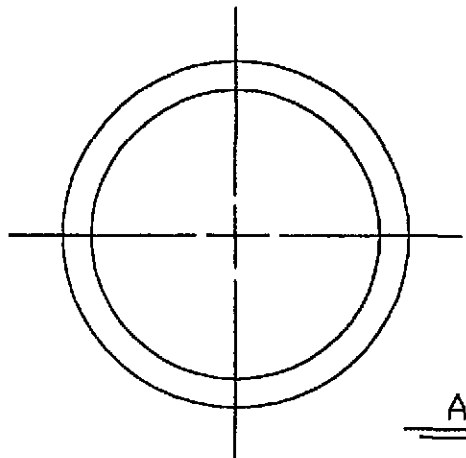
INSTALLED LENGTH OF
 SPOOL 317 5/8"



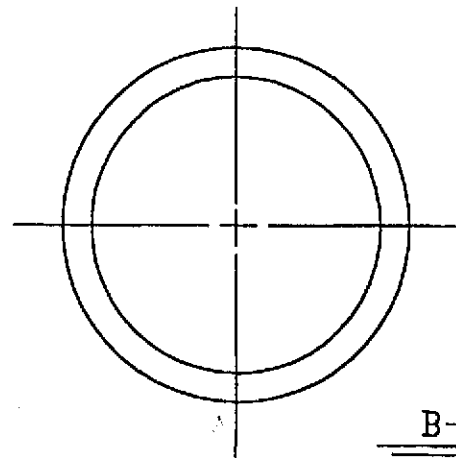
Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	<i>[Signature]</i>	24 July 98
	Buyer <i>[Signature]</i>	24 JUL 98
3. Final Component Location Complete	<i>[Signature]</i>	24 July 98
	Buyer <i>[Signature]</i>	24 JUL 98

SPECIFICATION

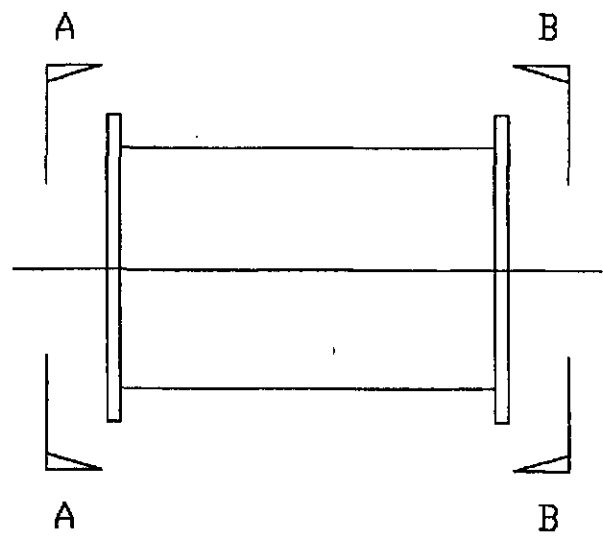
Number:	Rev.
A V049-2-174	2



A-A



B-B



*SPOOL ASSEMBLY INSTALLED BETWEEN
ALIGNED EQUIPMENT LGV-10 AND
LBSC5. NO ALIGNMENT REQUIRED*

Component ID: LAT-B1/2A-1A

Serial No.: S/W 03 / S/W 10

Title: **SPOOL PIECE
INSTALLED POSITION**

Job No.: V59049

Project: **LIGO Equipment Set**

Scale: **None**

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V55049		
Drawing: V049-5-009	Rev. 2	Date: 24 JUL 98		
Item Anchored: LATTB / LAHA	No. of Anchors 4	Size: 1"	Type: HAS STD	
Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (<u>HAS Std</u> or Super)	<i>TDS</i>	YES	24 JUL 98	
Spacing & Location	<i>TDS</i>	YES	↓	
Anchor Size & Length 1" x 15"	<i>TDS</i>	YES	↓	
Hole Size 1 1/8"	<i>TDS</i>	YES	↓	
Hole & Core Condition (no voids, etc.)	<i>TDS</i>	YES	↓	
Embedment (minus 0 plus 1/8") 8 1/4"	<i>TDS</i>	YES	↓	
Angle (90 deg. ± 1 deg.)	<i>TDS</i>	YES	↓	
Floor Scarified	<i>TDS</i>	YES	↓	
Proper Nut Engagement	<i>TDS</i>	YES	↓	
Tightening	<i>VSS MUR</i>	YES	17 AUG 98	
Torque Device Identification: AP-9 350 FT. LBI.				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>MUR</i>	Date: 24 JUL 98
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COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LA7B1 / LA-1A

Component Name:

LEFT END STATION SPOOL

Component S/N:

S/W 03 / S/W 010

Vacuum Sealing Surfaces Inspection

By:

TJS

24 JULY 98

Buyer:

NWE

24 JUL 98

Cleanliness Inspection

By:

TJS

24 July 98

Buyer:

NWE

24 JUL 98

Rings Installed

By:

TJS

24 July 98

Buyer:

NWE

24 JUL 98

Bolt Torque

By:

TJS

8-3-98

Comments:

Rework Required:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

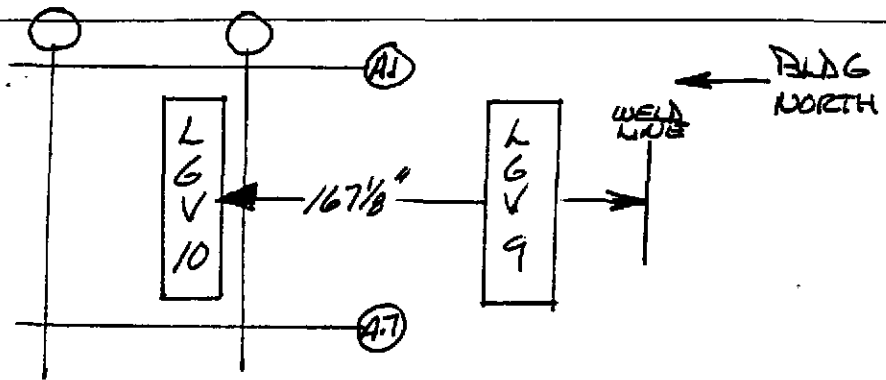
ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LGV 10
 Component Name LEFT END STATION GATE VALVE
 Component S/N 5/10 14
 Component Installation Weight (lb.) 7300 #

Component Installation Position
(Ref. D Build Grid)

NOTE!

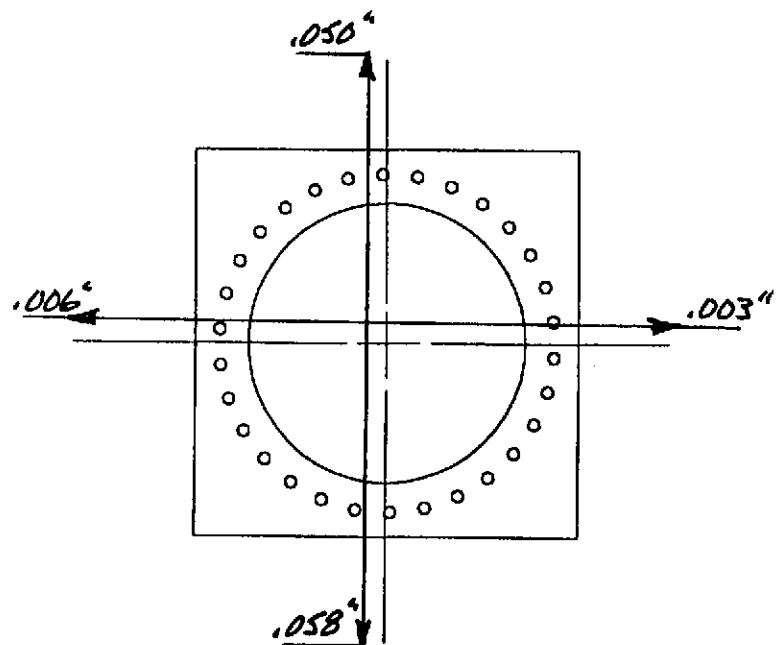
LGV-9 HAD NOT BEEN
INSTALLED AT THE TIME
OF LGV-10 INSTALLATION



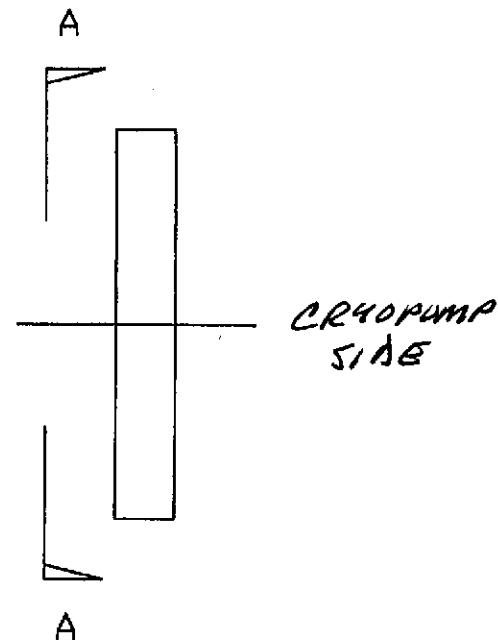
Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>JBS</i>	23 JULY 98
2. Component Located For Anchor Bolt Marking	<i>JBS</i>	23 JULY 98
	Buyer <i>JWE</i>	
3. Final Component Location Complete	<i>JBS</i>	23 July 98
	Buyer <i>JWE</i>	23 JUL 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

BLDG NORTH



MOUNTED ON THE NORTH
FACE OF LCP3



A-A

Component ID:

LGV-10

Serial No.:

S/N 14

Title:

GATE VALVE
INSTALLED POSITION

Job No.:

V59049

Project:

LIGD Equipment Set

Scale:

None

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049		
Drawing: V049-5-009	Rev. 2		Date: 24 JUL 98	
Item Anchored: L6V-10 SUPPORT	No. of Anchors 4		Size: 3/4"	Type: HAS STD
Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	N/A		24 JUL 98 ↓ 17 AUG 98
Spacing & Location	TBS	N/A		
Anchor Size & Length 3/4" x 13 3/8"	TBS	N/A		
Hole Size 7/8"	TBS	N/A		
Hole & Core Condition (no voids, etc.)	TBS	N/A		
Embedment (minus 0 plus 1/8") 6 5/8"	TBS	N/A		
Angle (90 deg. ± 1 deg.)	TBS	N/A		
Floor Scarified	TBS	N/A		
Proper Nut Engagement	TBS	N/A		
Tightening	TBS	N/A		
Torque Device Identification: AP-9 250 FT. LBS.				

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <u>MCE</u>	Date: 24 JUL 98
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COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LGV-10

Component Name: LEFT END STATION GATE VALVE

Component S/N: S/W 14

Vacuum Sealing Surfaces Inspection

By: TBS 23 July 98

Buyer: JMS 23 JUL 98

Cleanliness Inspection

By: TBS 23 July 98

Buyer: JMS 23 JUL 98

-Rings Installed

By: TBS 23 July 98

Buyer: JMS 23 JUL 98

Bolt Torque

By: TBS 8-3-98

Comments:

Rework Required:

Thur

DATE 7/23/78

LEFT END

PAGE # 71^o

MOVED TOOLS TO LEFT
END STATION.

SET GV-10 FINAL

ELEV:

WEST side

.006 LOW

EAST side

.003 LOW.

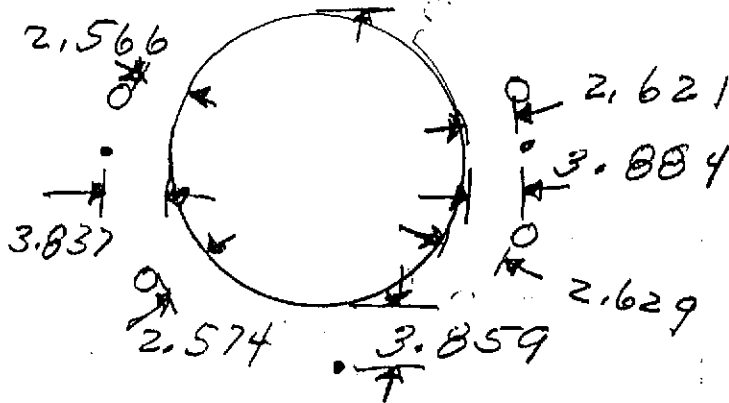
☿ OF VALUE

TOP .050 EAST OF ☿
BOT .058 EAST OF ☿

STU DID Q.C.
ALLEN SIEBLY
(OVER)

VALVE WAS BOLT
BOUND & COULD NOT
MOVE ANY FARTHER
WEST.

* ~~▲~~ SOUTH SIDE OF
CV-10 VALVE
1/4" DRILL HOLE
3.825



MEASURED WITH DIAL
CALIPERS

VALVE WAS OFF ϕ BY .056"
WHEN MATED TO CP-3, WHICH WAS
.015" WEST OF ϕ . WE WERE BOLT BOUND
COULD NOT MOVE WEST ANY FARTHER

Fri

DATE 7-24-98 LEFT END ST

PAGE # 71

INSTALLED SPOOL LA-7B2
BOLTED UP GOOD.
SET & PLUMBED LEGS
& DRILLED.

SET ANCHOR BOLTS
& REINSTALLED LEGS.

CORNER ST

GROUTED EAST SIDE
OF NAM-5 & 2 LEGS
ON MODE CLEANER

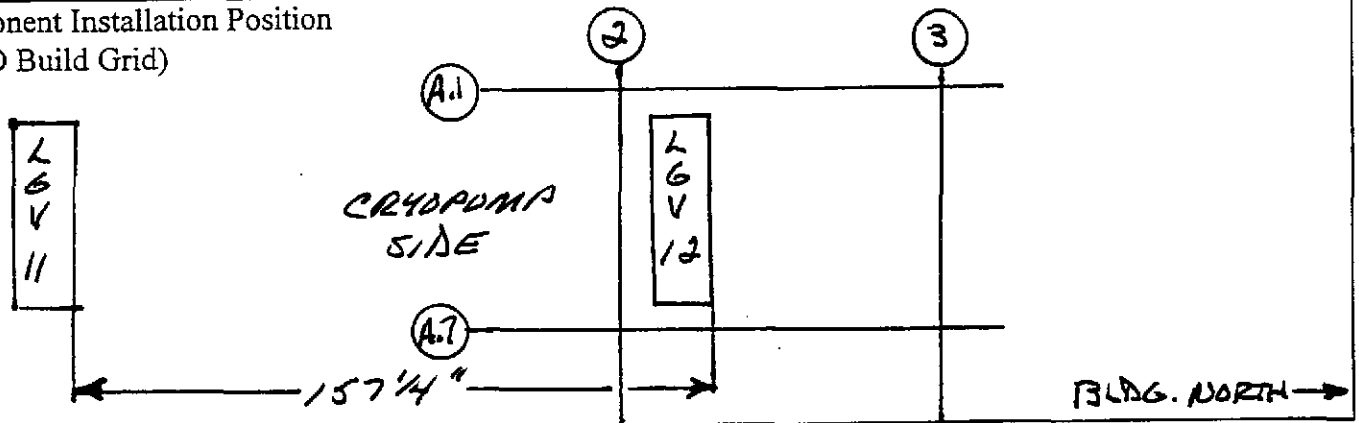
GROUTED BSC-3
LEGS

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LGV-12
 Component Name 44" GATE VALVE RIGHT END STA.
 Component S/N 5/10 030
 Component Installation Weight (lb.) 7300 #

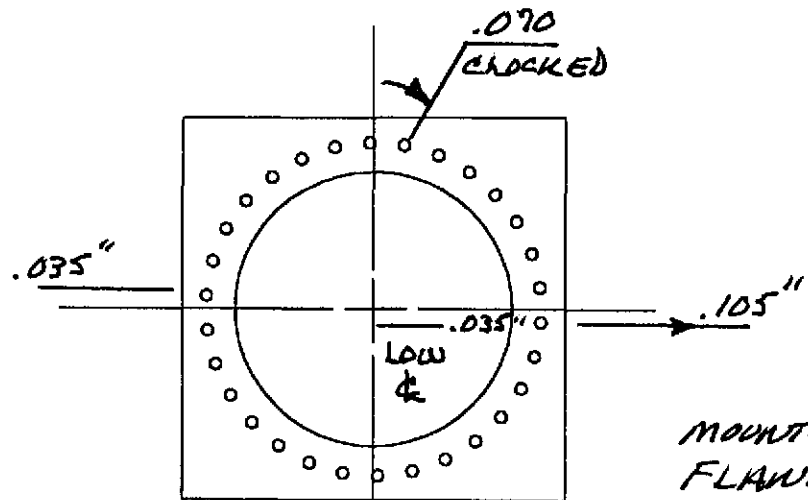
Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TSS.</i>	14 MAY 98
2. Component Located For Anchor Bolt Marking	<i>TSS</i>	14 MAY 98
	Buyer <i>MSE</i>	14 MAY 98
3. Final Component Location Complete	<i>TSS</i>	15 MAY 98
	Buyer <i>MSE</i>	15 MAY 98

SPECIFICATION

Number: A V049-2-174 Rev. 2

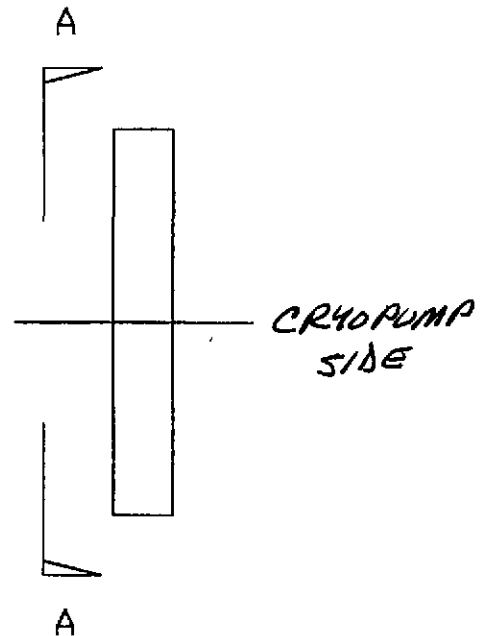


.037
SHOT

.043
CORRECTED
(.070 - .027 = .043)

A-A

MOUNTED ON THE EAST
FLANGE OF LCP4



Component ID: LGV-17

Serial No.: S/W 030

$.105 - .035 = .070 \times .5 = .035"$

$.048$ HIGHER THAN CONTROL POINT

6'1.048"

Title: GATE VALVE INSTALLED POSITION	Job No.: V59049	
	Scale: None	Dwn By:
Project: LIGO Equipment Set		

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-008	Rev. 2	Date: 14 MAY 98	
Item Anchored: LGV-12 SUPPORT	No. of Anchors 4	Size: 3/4"	Type: HAS ST1

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (<u>HAS Std</u>) or Super)	TDS	N/A		15 MAY 98
Spacing & Location	TDS	N/A		
Anchor Size & Length 3/4" x 13 3/8"	TDS	N/A		
Hole Size 7/8"	TDS	N/A		
Hole & Core Condition (no voids, etc.)	TDS	N/A		
Embedment (minus 0 plus 1/8") 6 3/8"	TDS	N/A		
Angle (90 deg. ± 1deg.)	TDS	N/A		
Floor Scarified	TDS	N/A		
Proper Nut Engagement	TDS	N/A		
Tightening	TDS (N/A)	N/A		13 AUG 98
Torque Device Identification: AP-9 250 FT. LBS				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: N/A	Date: 15 MAY 98
---------------------------	------------------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LGV-12

Component Name:

44" GATE VALVE RIGHT END STA.

Component S/N:

S/N 030

Vacuum Sealing Surfaces Inspection

By:

TJ28 15 MAY 98

Buyer:

JWE 15 MAY 98

Cleanliness Inspection

By:

TJ28 15 MAY 98

Buyer:

JWE 15 MAY 98

O-Rings Installed

By:

TJ28 15 MAY 98

Buyer:

JWE 15 MAY 98

Bolt Torque

By:

TJ28 7-30-98

Comments:

Rework Required:

FRIDAY

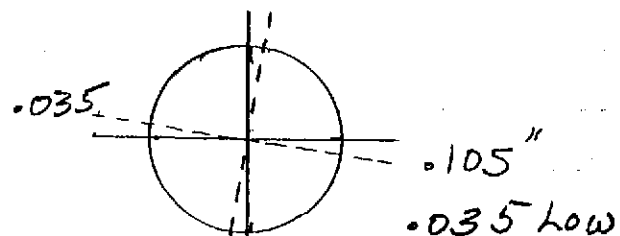
DATE 5/15/98

RIGHT END ST

PAGE #

71

SET GV-12.



.070 - .027 = .043 SOUTH OF ϕ
SHOT .027 NORTH OF ϕ
VALUE SET .048" ABOVE
VALUE ϕ . CALC.

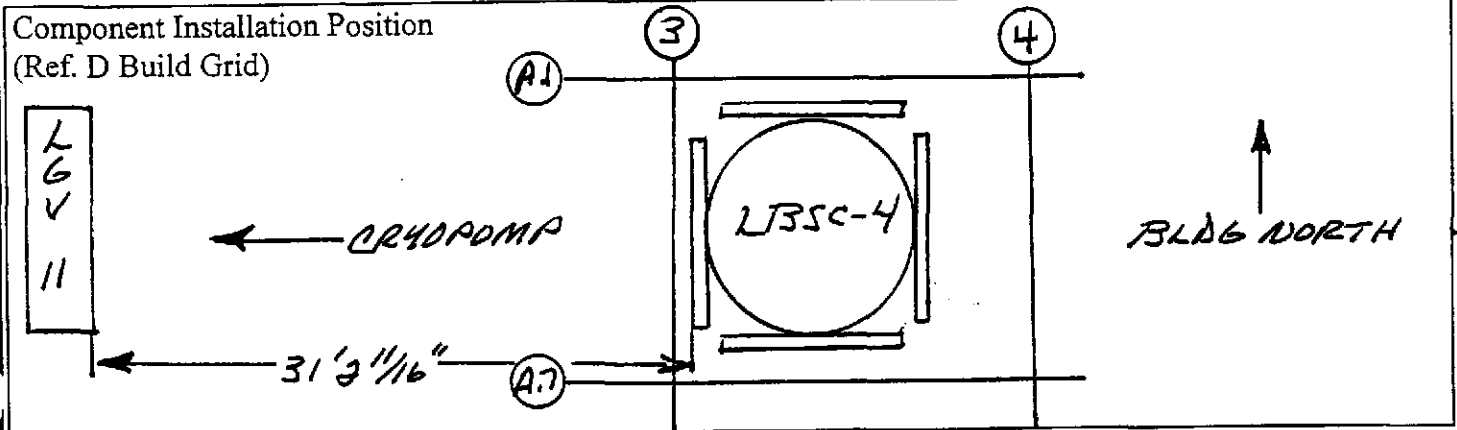
ACTUAL: .013 ABOVE ϕ

VALUE IS Clocked IN
CLOCKWISE DIRECTION .070"
BOLT BOUND & SAGGED
.035" OVERNIGHT AS
RUBBER SUPPORT COLLAPSED.
QC. BY DAVE EVERS &
ALLEN SIBLEY

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

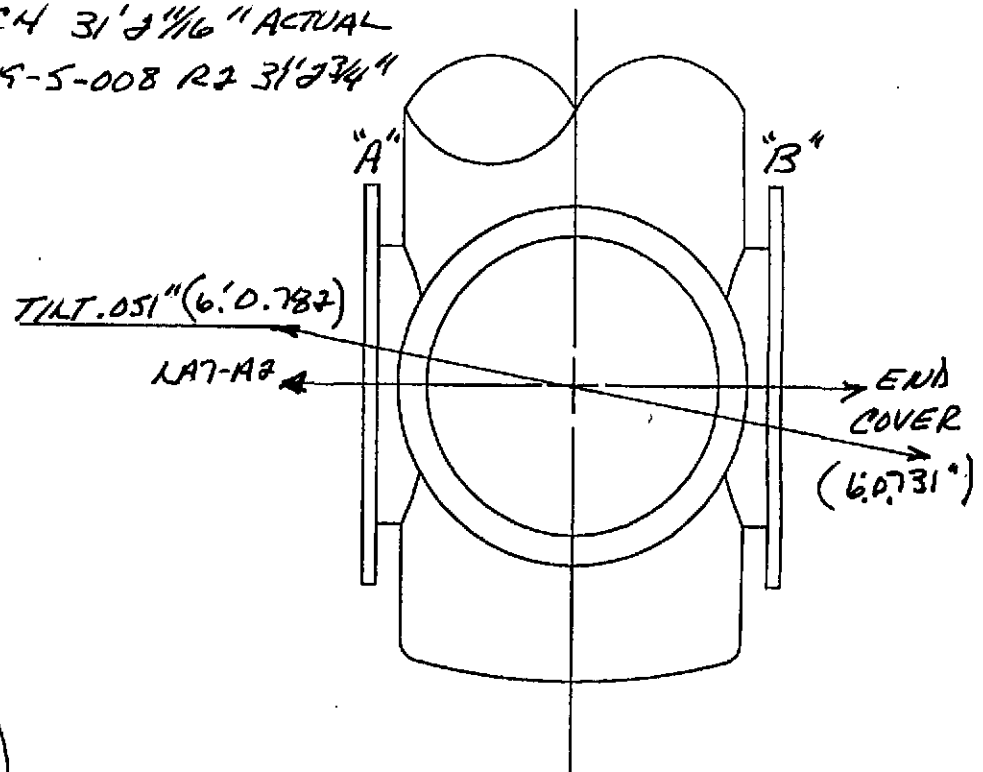
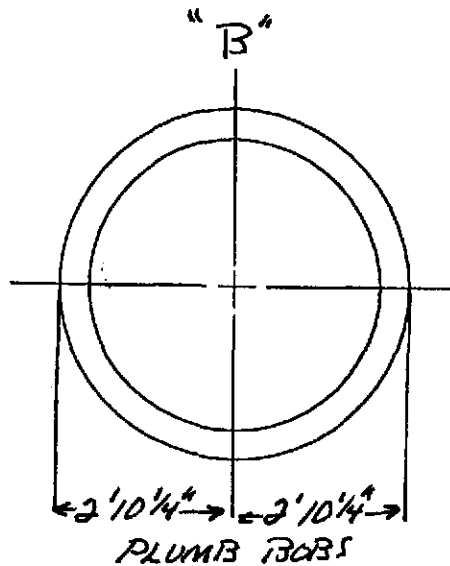
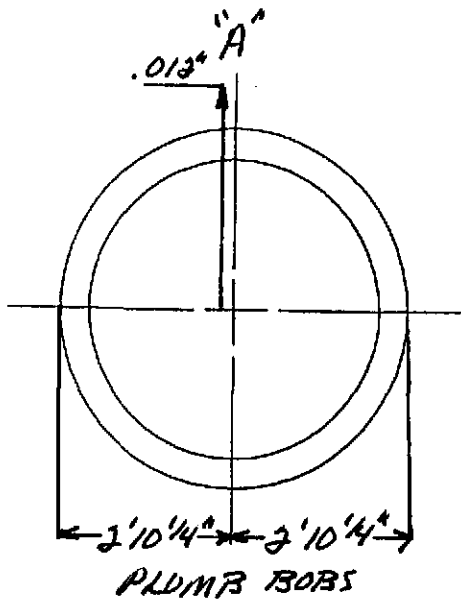
Component Tag Number LBSC-4
 Component Name BEAM SPLITTER RIGHT END STA.
 Component S/N S/N 14
 Component Installation Weight (lb.) 30000 #



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	TSS	12 MAY 98
2.	Component Located For Anchor Bolt Marking	TSS	12 MAY 98
		Buyer: JSE	12 MAY 98
3.	Final Component Location Complete	TSS	13 MAY 98
		Buyer: JSE	13 MAY 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

- MEASUREMENT FROM THE EAST FACE OF LGV-11 TO THE WEST FACE OF LBSC4 31' 2 1/16" ACTUAL
- PER DRWG V049-5-008 R2 31' 2 3/4"



Component ID:

LBSC4

Serial No.:

S/N 14

BEAM LINE SLOPE .00376"/FT

ACTUAL TILT .051"

(TRM) 6' 0.675

Title:

BEAM SPLITTER
INSTALLED POSITION

Job No.:

V59049

Project:

LIGO Equipment Set

Scale:

None

Dwn By:

BEAM LINE SLOPE .00376"/FT ACTUAL TILT .051" (TRM) 6' 0.675	Title: BEAM SPLITTER INSTALLED POSITION		Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set		Scale: None	Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-008	Rev. 2	Date: 12 MA 4 98	
Item Anchored: LBSC-4	No. of Anchors: 16	Size: 1"	Type: SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or <u>Super</u>)	TBS	N/A		12 MA 4 98
Spacing & Location	TBS	N/A		12 MA 4 98
Anchor Size & Length 1" x 1 1/2" 1" x 1 1/2"	TBS	N/A		12 MA 4 98
Hole Size 1 1/8"	TBS	N/A		12 MA 4 98
Hole & Core Condition (no voids, etc.)	TBS	N/A		12 MA 4 98
Embedment (minus 0 plus 1/8") 8 1/4" / 12 3/8"	TBS	N/A		12 MA 4 98
Angle (90 deg. + 1 deg.)	TBS	N/A		12 MA 4 98
Floor Scarified	TBS	N/A		12 MA 4 98
Proper Nut Engagement	TBS	N/A		13 MA 4 98
Tightening	T65 N/A	N/A		13 AU 6 98

Torque Device Identification: AP-9 400 FT-165

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by:	Date: 12-13 MA 4 98
----------------	---------------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LBSC-4

Component Name:

BEAM SPLITTER RIGHT END STA.

Component S/N:

S/N 14

Vacuum Sealing Surfaces Inspection

By:

VTS

18 MAY 98

Buyer:

NSE

18 MAY 98

Cleanliness Inspection

By:

VTS

18 MAY 98

Buyer:

NSE

18 MAY 98

O-Rings Installed

By:

VTS

18 MAY 98

Buyer:

NSE

18 MAY 98

Bolt Torque

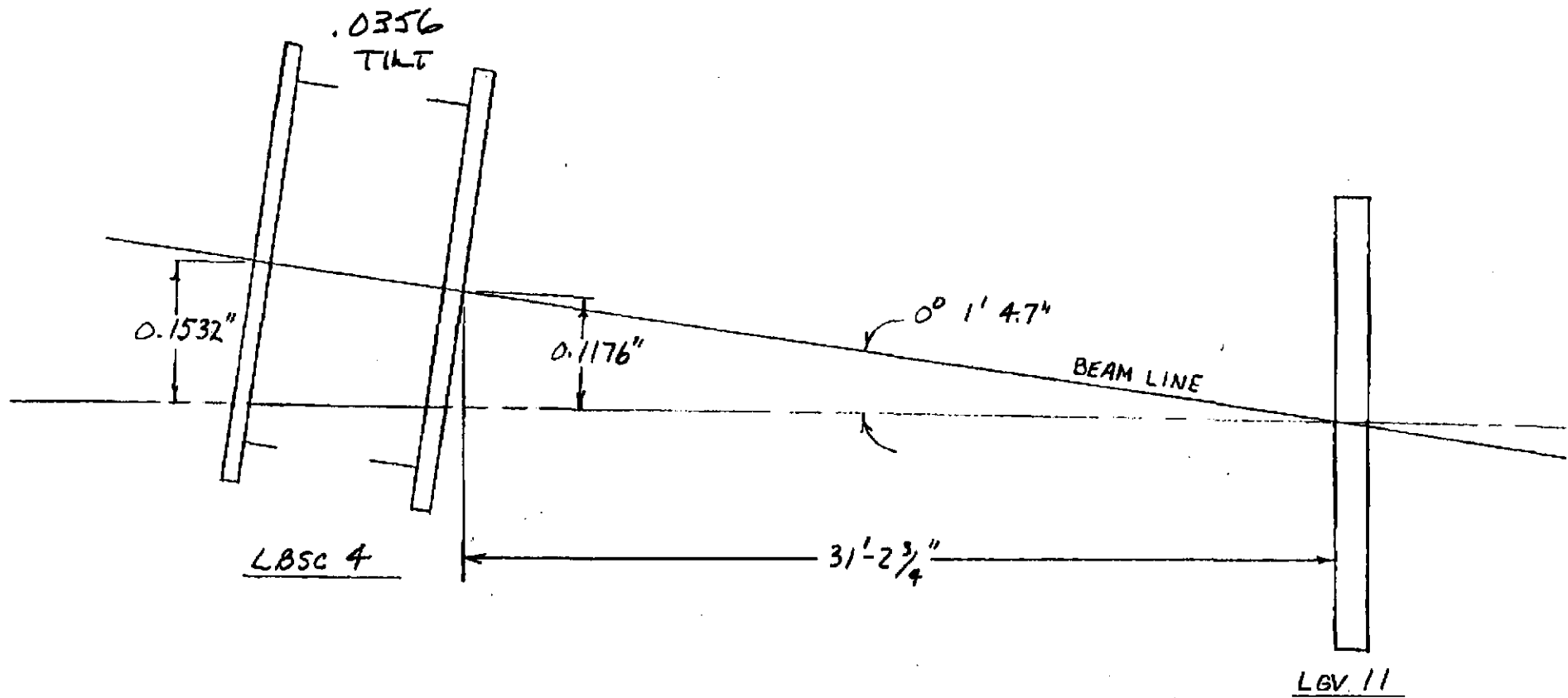
By:

VTS

7-30-98

Comments:

Rework Required:



LIVINGSTON X ARM

.116
.038

.154

WEDNESDAY

DATE 5/13/78

RIGHT END ST

PAGE #

73⁰

SET BSC-4 FOR FINAL
ALIGNMENT.

ELEVATION:

VALUE END SET @ .116"

ACTUAL: .010 Low

.106 BELOW VALUE &

OTHER END @ .154

ACTUAL: .157

DUAL BOBS

2' 10 1/4" BOTH SIDES

Monday

DATE

5/11/78 Right end ST

PAGE # 70

SET B.S. = 4 FOR PRE BOLT,
PLUMBED W/ 98 ON 104"
FLANGE \approx $\frac{1}{4}$ GRAD OUT
PERPENDICULAR TO B.L.
HIGH TO SOUTH.

$\frac{1}{2}$ GRAD HIGH TO VALVE
SIDE ON B.L.

VALVE END FLANGE:
CALC: $31' 2\frac{3}{4}"$ FROM VALVE
FACE TO FACE OF B.S. FLANGE
MEAS. $31' 2\frac{11}{16}"$ ACT.

Tuesday

DATE 5/12/98

RIGHT END ST.

PAGE # 71^o

DRILLED HOLES FOR BSC-4
& SET BOLTS.

Bushed PADS & CLEANED
8 - 12 $\frac{3}{8}$ " IMBED & 8 - 8 $\frac{1}{4}$ " IMBED

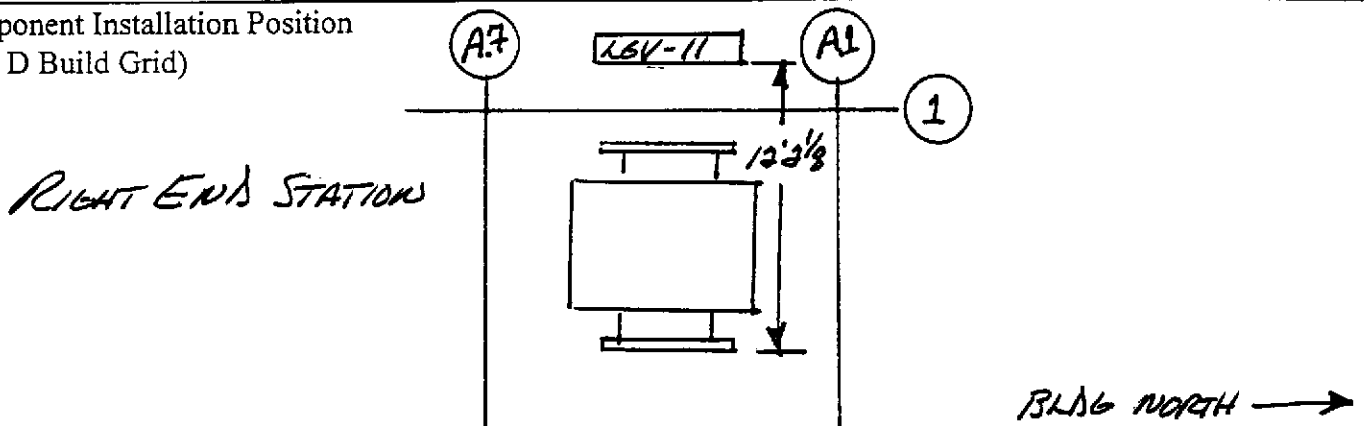
BROKE DIAMOND RING FROM
DRILL BIT IN REBAR. USED
1" DRILL BIT IN A CORE
DRILL SLEEVE TO DRILL
OUT REBAR TO FACILITATE
EXTRACTING DIAMOND SECTION
WORKED OK.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LCP 4 / LBE-4A
 Component Name CRYO PUMP
 Component S/N S/N 04 / S/N 09
 Component Installation Weight (lb.) 9000# w/BE-4 SPOOL

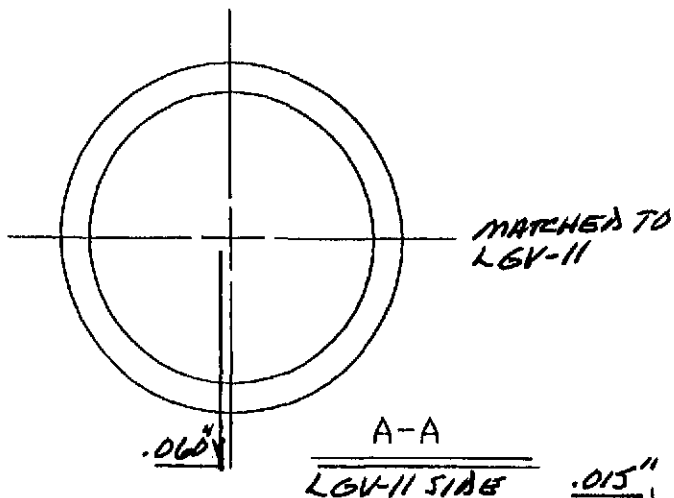
Component Installation Position
(Ref. D Build Grid)



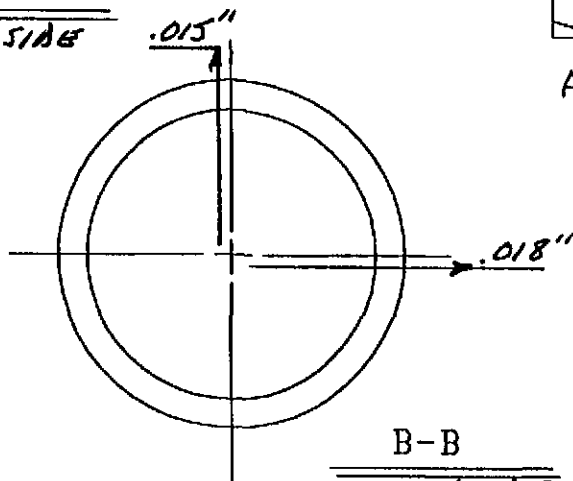
Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>JDS</i>	7 MAY 98
2.	Component Located For Anchor Bolt Marking	<i>JDS</i>	7 MAY 98
		Buyer <i>JMS</i>	7 MAY 98
3.	Final Component Location Complete	<i>JDS</i>	11 MAY 98
		Buyer <i>JMS</i>	11 MAY 98

SPECIFICATION

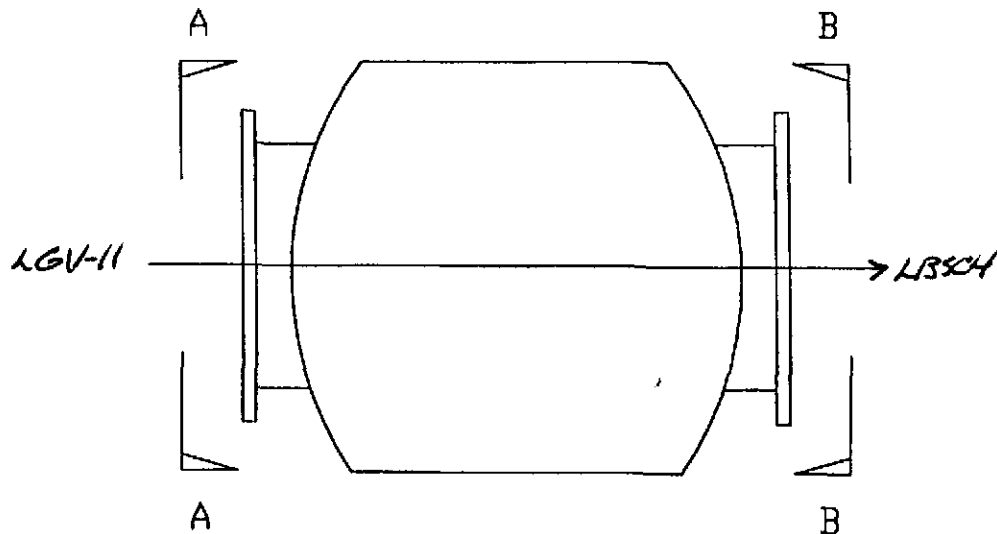
Number:	Rev.
A V049-2-174	2



A-A
LGV-11 SIDE



B-B
LRS04 SIDE



- MEASUREMENT FROM THE EAST FACE OF LCP4 TO THE EAST FACE OF LGV-11 12' 2 1/8"
- PER DRAWING V049-5-008 R2 12' 9"

Component ID:

LCP4 / LRS04

Serial No.:

S/N 04 / S/N 09

	①	②	△
Calc			
Shot			

Gv-11 SET BY CBI .068" LOW
PER TERM. SLAB MONUMENT

TOTAL TILT .018"

Title:

CRYO PUMP
INSTALLED POSITION

Job No.:

V59049

Project:

LIGO Equipment Set

Scale:

None

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049
Drawing: V045-5-008	Rev. 2	Date: 7 MAY 98
Item Anchored: CR40 PUMP LCP4/LREYA	No. of Anchors: 16	Size: 1" Type: HVA SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or <u>Super</u>)	TJL	MSE		7 MAY 98
Spacing & Location	TJL	MSE		7 MAY 98
Anchor Size & Length 1" x 1 9/16"	TJL	MSE		7 MAY 98
Hole Size 1 1/8"	TJL	MSE		7 MAY 98
Hole & Core Condition (no voids, etc.)	TJL	MSE		7 MAY 98
Embedment (minus 0 plus 1/8") 1 3/16"	TJL	MSE		7 MAY 98
Angle (90 deg. + 1 deg.)	TJL	MSE		8 MAY 98
Floor Scarified	TJL	MSE		8 MAY 98
Proper Nut Engagement	TJL	MSE		11 MAY 98
Tightening	TJL	MSE		13 AUG 98
Torque Device Identification: AP-9 400 FT. LBS.				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <u>MSE</u>	Date: 7 MAY 98
---------------------------	----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LCP 4 / LBE-4A

Component Name:

CR40 PUMP

Component S/N:

S/N 04 / S/N 09

Vacuum Sealing Surfaces Inspection

By:

JDS 11 MAY 98

Buyer:

JSE 11 MAY 98

Cleanliness Inspection

By:

JDS 11-MAY 98

Buyer:

JSE 11 MAY 98

O-Rings Installed

By:

JDS 11 MAY 98

Buyer:

JSE 11 MAY 98

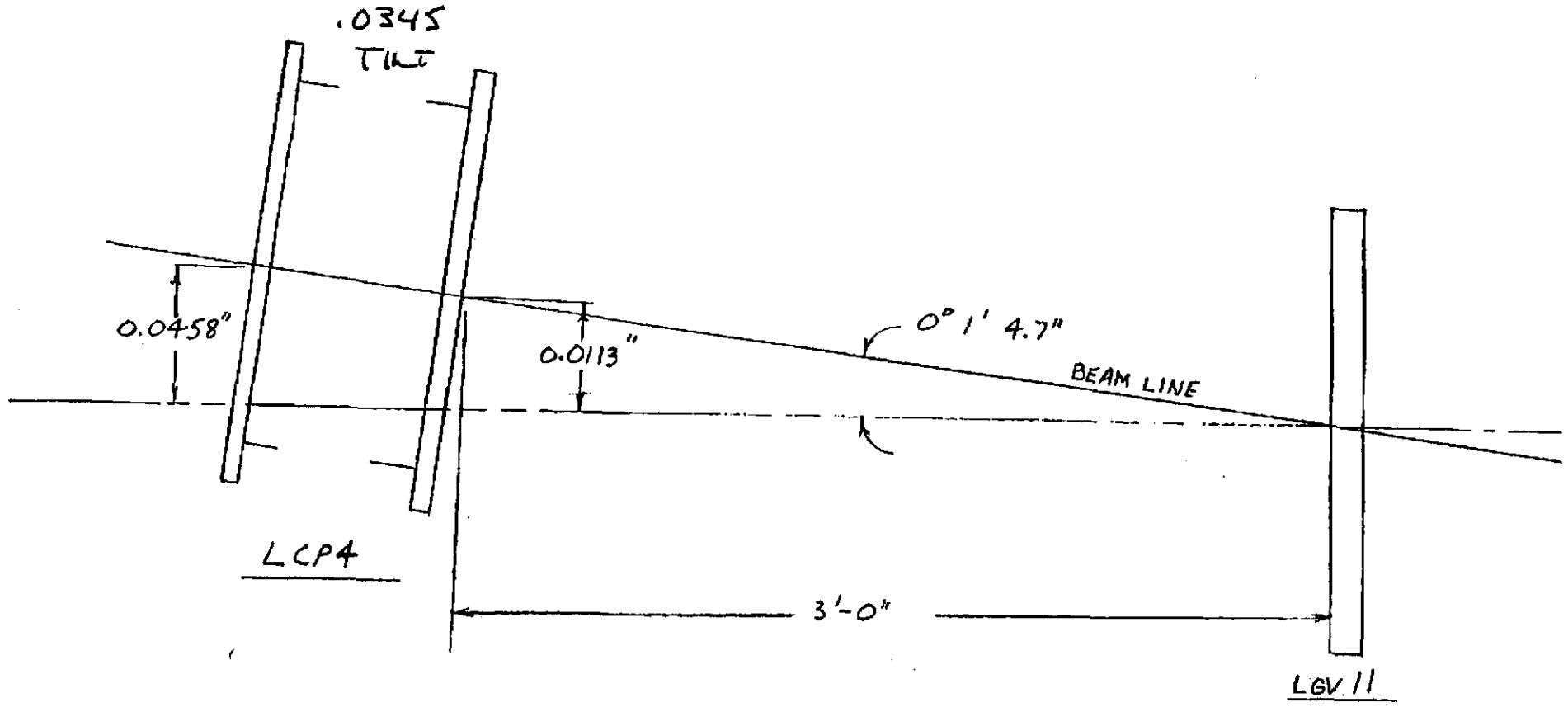
Bolt Torque

By:

JDS 7-30-98

Comments:

Rework Required:



LIVINGSTON X ARM

Monday

DATE

5/11/98

RIGHT END ST

PAGE #

71

FINAL ON CP-4:
SET UP INST. & RE SHOT
CP-4:

VALVE END .065
SOUTH OF ϕ , (MOVED OVER
SUNDAY)

B.S. END .015" SOUTH
OF ϕ .

ELEV:

.018" ABOVE VALVE ϕ
(LOST HEIGHT OVER SUNDAY)
(POSSIBLE TEMP DIFF.)

12' 2" FROM VALVE
FACE CALC:

$\approx 1/8$ " (12' 2 1/8") TOO FAR
FROM VALVE.

DAVE EVERS DID Q.C.
& BOUGHT THE SET.

DATE

5/8/90

RIGHT END ST

PAGE #

74⁰

SET CRYO PUMP #4 FINAL
ELEV. B.S. END .042"
ABOVE VALVE ϕ .

ϕ B.S. END .015" SOUTH
OF CL

VALVE END NORTH
.060"

SET CP-4 FOR BOLT
DRILLING. DUAL PLUMB BOB
USED ON VALVE END C.P.
FLANGE.

BOB'S READ $2'2\frac{1}{8}"$
EACH SIDE OF ϕ

SHOT B.S. END WITH
DIG TRANSIT.

SET @ $12'2"$ FROM VALVE
FACE TO FACE OF FLANGE
ON B.S. END. LEGS PLUM
& $80"$ INSIDE.

DIMPLED USING SLEEVE
& DRILLED HOLES

* DID A DUMP TEST ON
NEW BRUNSON @ $\approx 25'$
REPEATED TO $\approx 100'.$

SET CR4 @ .042" ABOVE
VALVE ϕ .

FINAL SATURDAY.

B.S. END .025" SOUTH
of ϕ

ELEV:

.026" ABOVE VALVE ϕ
VALVE END .030" SOUTH
of ϕ

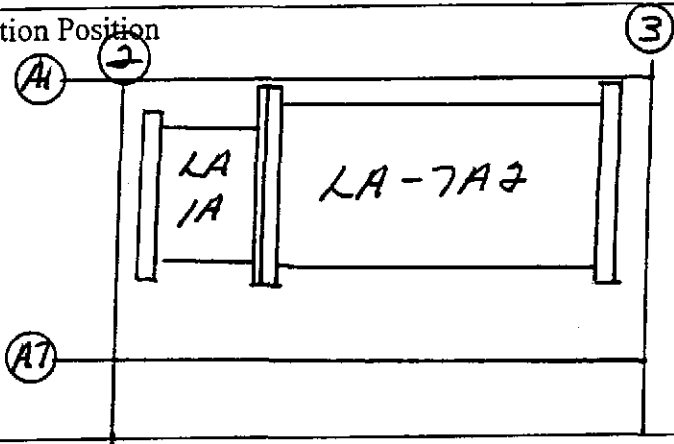
B.S. END .25" SOUTH of
 ϕ . SHOT WITH BRUNSON
DUAL BOBS ON VALVE
END

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA-7A2 / LA-1A
 Component Name SPOOL, RIGHT END STATION
 Component S/N 03 / 07
 Component Installation Weight (lb.) 6500#

Component Installation Position
 (Ref. D Build Grid)

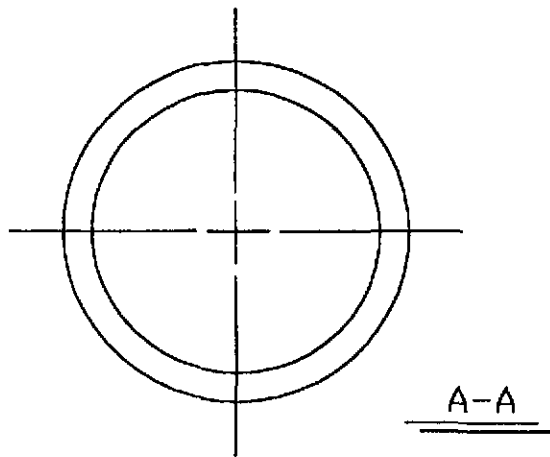


INSTALLED LENGTH OF
 SPOOLS 317 1/16"
 PER DRAWING V049-5-008
 317 5/8"

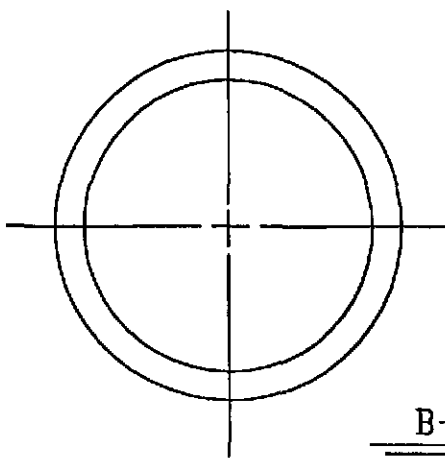
Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	TBS	16 MAY 98
	Buyer: MSE	16 MAY 98
3. Final Component Location Complete	TBS	16 MAY 98
	Buyer: MSE	16 MAY 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

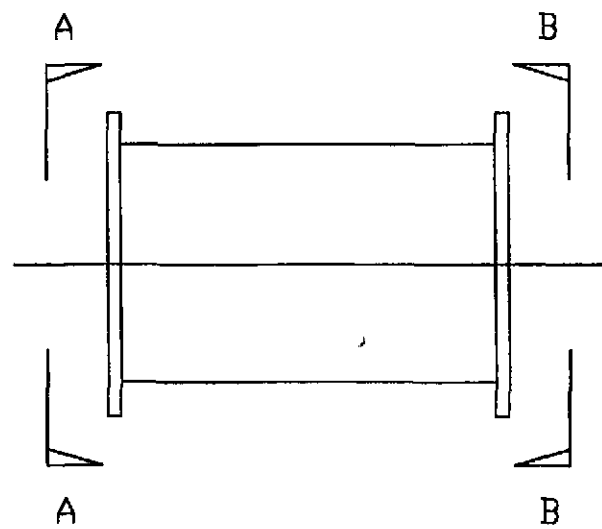
↑
BLDG
NORTH



A-A



B-B



SPOOL ASSEMBLY INSTALLED BETWEEN
ALIGNED EQUIPMENT LGV-12 AND
LBSC4, NO ALIGNMENT REQUIRED

Component ID: LA-7A2/LA-1A

Serial No.: S/N 03/07

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: V55049
	Project: LIGO Equipment Set	Scale: None Dwn By:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LA-7A2 / LA-1A

Component Name:

SPOOL

Component S/N:

S/N 03 / 07

Vacuum Sealing Surfaces Inspection

By:

JTS 18 MAY 98

Buyer:

MSE 18 MAY 98

Cleanliness Inspection

By:

JTS 18 MAY 98

Buyer:

MSE 18 MAY 98

O-Rings Installed

By:

JTS 18 MAY 98

Buyer:

MSE 18 MAY 98

Bolt Torque

By:

JTS 7-30-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049
Drawing: V045-5-008	Rev. 2	Date: 16 MAY 98
Item Anchored: LA-7A2/LA-1	No. of Anchors 4	Size: 1" Type: HAS STD

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std) or Super)	TBS	AKS		18 MAY 98	
Spacing & Location	TBS	AKS		↓	
Anchor Size & Length 1" x 15"	TBS	AKS			
Hole Size 1 1/8"	TBS	AKS			
Hole & Core Condition (no voids, etc.)	TBS	AKS			
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	AKS			
Angle (90 deg. + 1 deg.)	TBS	AKS			
Floor Scarified	TBS	AKS			
Proper Nut Engagement	TBS	AKS			
Tightening	TBS AKS	AKS			13 AUG 98
Torque Device Identification: AP-9 250 FT.LBS					

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>[Signature]</i>	Date: 18 MAY 98
-----------------------------------	-----------------

MON.

DATE

5/18/78

RIGHT END ST

PAGE #

71

SET SPOOL PIECE BETWEEN
VALVE & B.S.

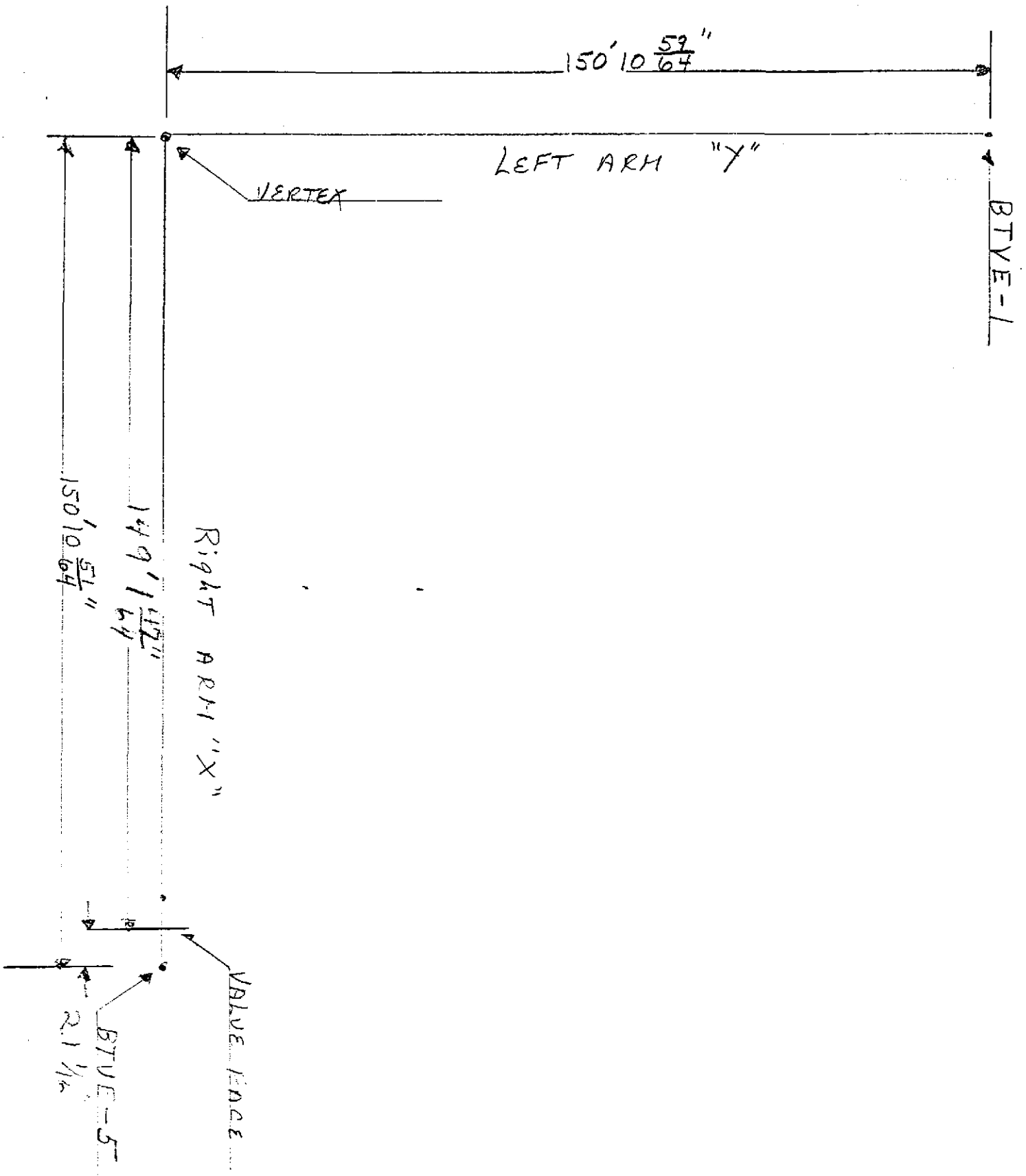
BOLTED LEGS, SCARIFIED
FLOOR. SET 14" GATE VALVE.

* MUST BLEED VACUUM TO
GET LOWER FLANGE COVER
OFF. ELECTRICAL HOOKUP
PARALLEL TO BEAM LINE AND
PUMP OUT PORT TOWARD
VALVE OPERATOR (HAND
WHEEL) ON ION PUMP.
STUTS ARE $3/8"$ X $2 1/4$ FINE
THREAD.

* NOTE NO TORQUE ON FLANGE
BOLTS AT THIS STATION.
RIPPED 14" VALVE WITH 4 (FOUR)
EYE BOLTS & SLINGS.

LOUISIANA CORNER STATION
VERTEX TO VALVE & MONUMENT
DIMENSIONS:

5-20-98
70°
LUFKID CHAIN
NO TEMP. CORRECTION

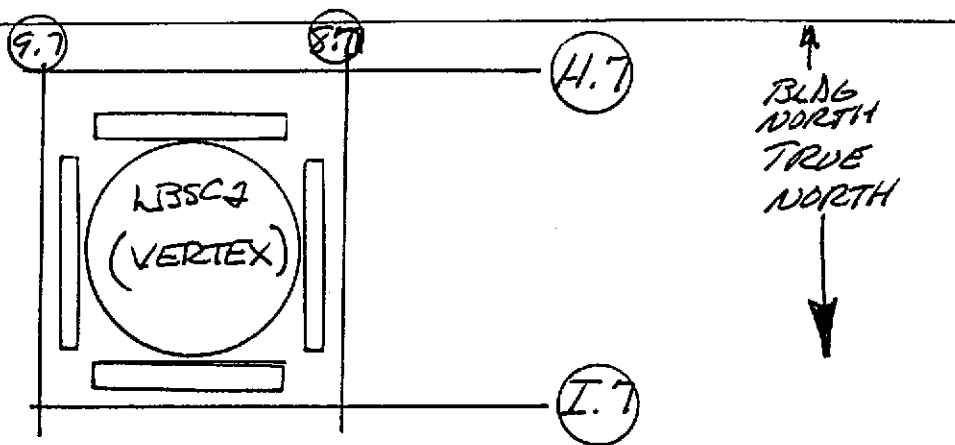


Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBSC-2
 Component Name CORNER STA. VERTEX BEAM SPLITTER
 Component S/N S/N 12
 Component Installation Weight (lb.) 20000#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TBS</i>	30 MAY 98
2. Component Located For Anchor Bolt Marking	<i>TBS</i>	30 MAY 98
	Buyer <i>NMS</i>	30 MAY 98
3. Final Component Location Complete	<i>TBS</i>	30 MAY 98
	Buyer <i>NMS</i>	1 JUN 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LRJC-2

Component Name: CORNER STA. VERTEX BEAM SPLITTER

Component S/N: S/N 17

Vacuum Sealing Surfaces Inspection

By: TBS 1 JUNE 98

Buyer: MSE 1 JUN 98

Cleanliness Inspection

By: TBS 1 JUNE 98

Buyer: MSE 1 JUN 98

O-Rings Installed

By: TBS 1 JUNE 98

Buyer: MSE 1 JUN 98

Bolt Torque

By: TBS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049
Drawing: V049-5-003	Rev. 3	Date: 29 MAY 98
Item Anchored: LBSC-2 LBSC-2	No. of Anchors: 16	Size: Type: HAS-STA

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super)	TBS	WMS		29 MAY 98	
Spacing & Location	TBS	WMS		↓	
Anchor Size & Length 1" x 15"	TBS	WMS			
Hole Size 1 1/8"	TBS	WMS			
Hole & Core Condition (no voids, etc.)	TBS	WMS			
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	WMS			
Angle (90 deg. ± 1deg.)	TBS	WMS			
Floor Scarified	TBS	WMS			1 JUN 98
Proper Nut Engagement	TBS	WMS			1 JUN 98
Tightening	TBS	WMS			28 AUG 98

Torque Device Identification: AP-9 250 FT. LBS.

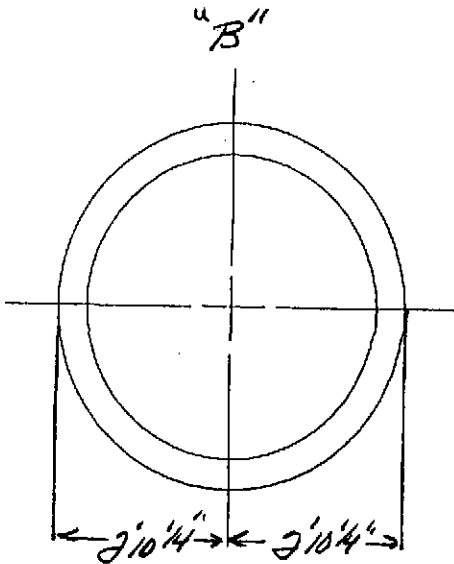
Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

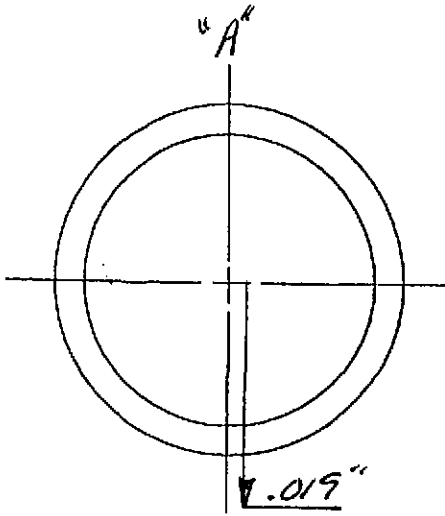
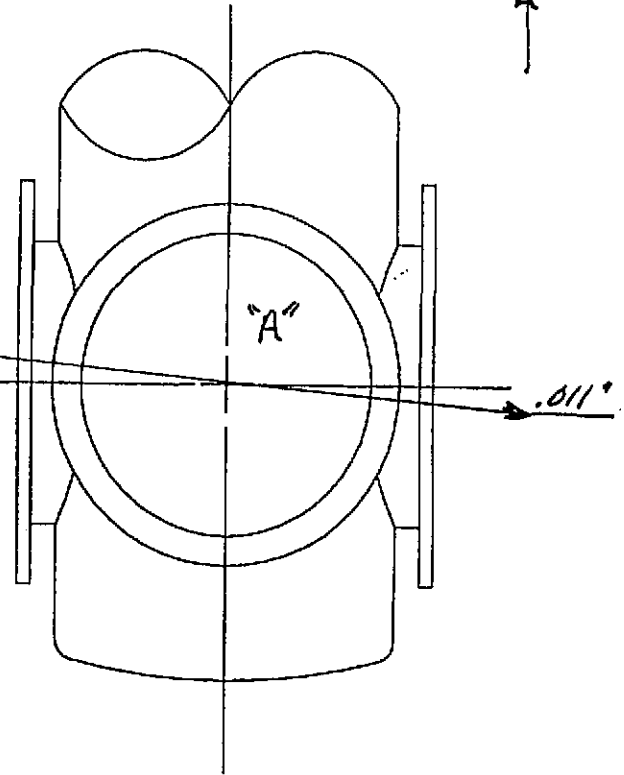
Inspection by: <i>[Signature]</i>	Date: 29 MAY 98
-----------------------------------	-----------------

RJSG
NORTH
A
↑



TILT .035
(.024" + .011" = .035")

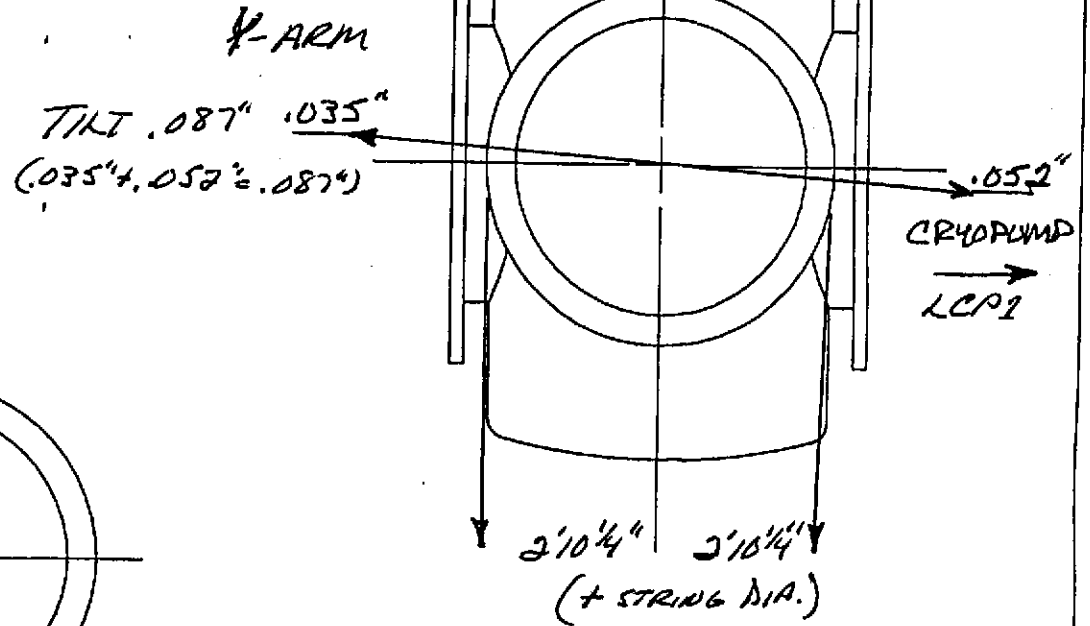
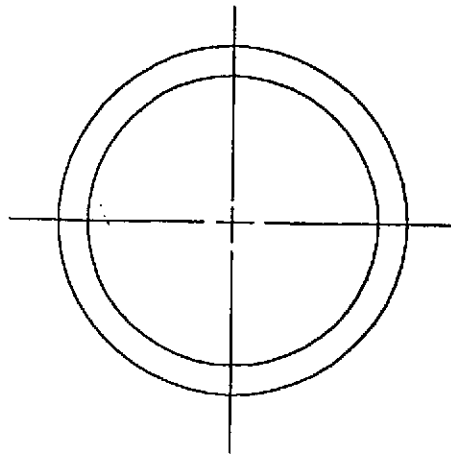
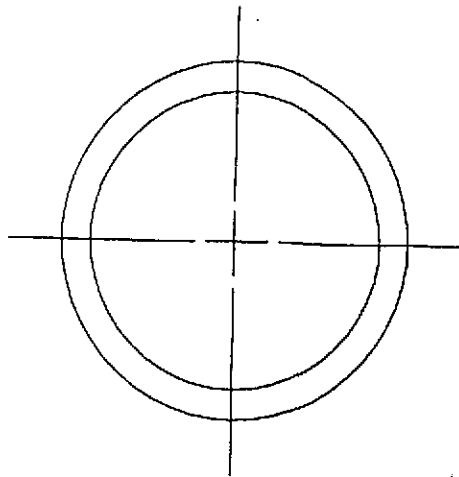
X-ARM
RIGHT



Component ID: LRSC 2 (VERTEX)
 Serial No: 5/12/7 (X-ARM)

APPROVED BY A. SIBLEY 1 JUN 98

	Title: BEAM SPLITTER INSTALLED POSITION	Job No: V59049	
	Project: LIGO Equipment Set	Scale: None	Dwn By:



Component ID: LBSC-2 (VERTEX)

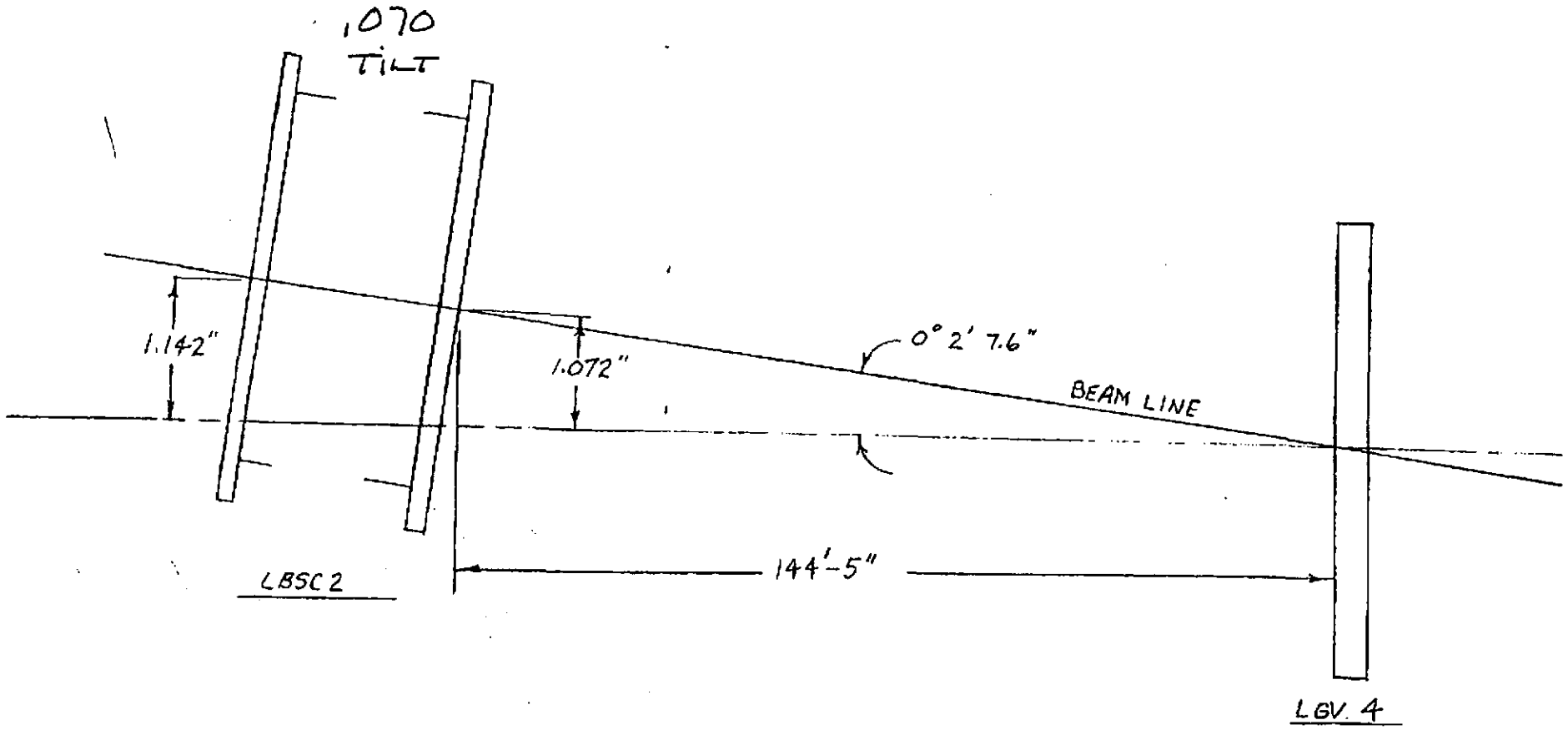
Serial No.: S/N 12 (Y-ARM)

APPROVED: A. SIBBLEY 1 JUN 98

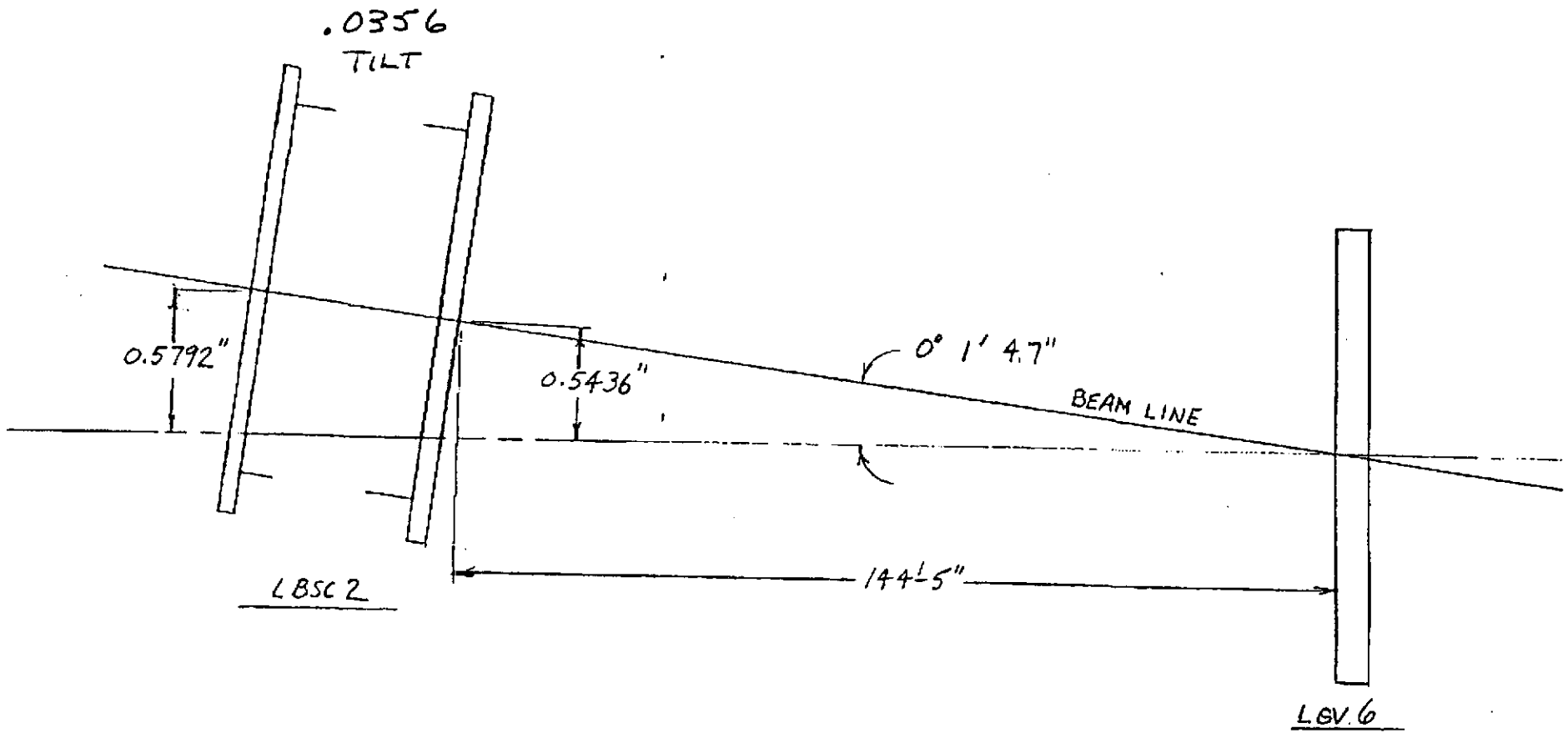
TILT OF Y-ARM $.035 + .052 = .087$
 CALC. = $.070 \cdot 0.17 \Delta \times .5 = .0085$

Y-ARM (LEFT)

Title: BEAM SPLITTER INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None



LIVINGSTON Y ARM



LIVINGSTON X ARM

SATURDAY

OUTSIDE 93°

DATE 5/30/98

CORNER ST

PAGE # 71

CONTINUED SETTING BSC-
FOR PREBOLT LOCATION.

TILT ON LEFT ARM IS
.071" ACROSS B.S.

RIGHT ARM TILT IS CALC
.033" ACROSS B.S.

ACTUAL TILT AS
DRILLED

LEFT ARM .061"

RIGHT ARM .052"

HOLES IN THE PADS ON
BSC-2 ARE $1\frac{9}{16}$ " ON S.W.
LEG & $1\frac{1}{2}$ " ON OTHER
LEGS.

DUAL BOBS USED ON
ALL 4 FLANGES. WITH TILT,
 $\pm .015$ OF & BOTH WAYS

TILT ESTABLISHED WITH
TWO PRECISION LEVELS
READ SET TO SAME
T.B.M.

DIMPLED & STARTED
DRILLING BOLT HOLES.
SAT. PM.

MOVED 6144 2.060" WEST 6-27-98

MONDAY

DATE 6-1-98

CORNER ST.

AC OFF

PAGE # 80

FINAL SET BSC-2

NORTH
+1.035 ± 1.035"

± @ VERTEX
ELEVATION

- .011"
- .018

+ .024" ACTUAL EAST
+ 1.018 CALC.

- .035 - .052"

S

X-ARM SHOT WITH FIG
TRANSIT: B.S. .028" SOUTH
OF ±.

OTHER BORES SET WITH
DUAL BOBS @ 2' 2 1/4" ± .01

B.C. DAVE EVERS
ALLEN SIEBLY

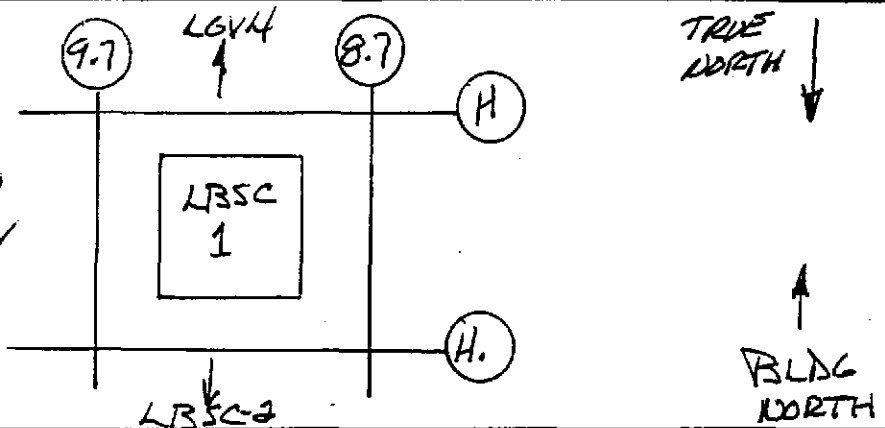
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBSC-1
 Component Name BEAM SPLITTER - CORNER STA. LEFT ARM
 Component S/N 5/12/11
 Component Installation Weight (lb.) 30000#

Component Installation Position
 (Ref. D Build Grid)

MEASUREMENT FROM THE
 NORTH FACE OF LBSC 2 TO
 THE SOUTH FACE OF LBSC 1
 66 9/16"

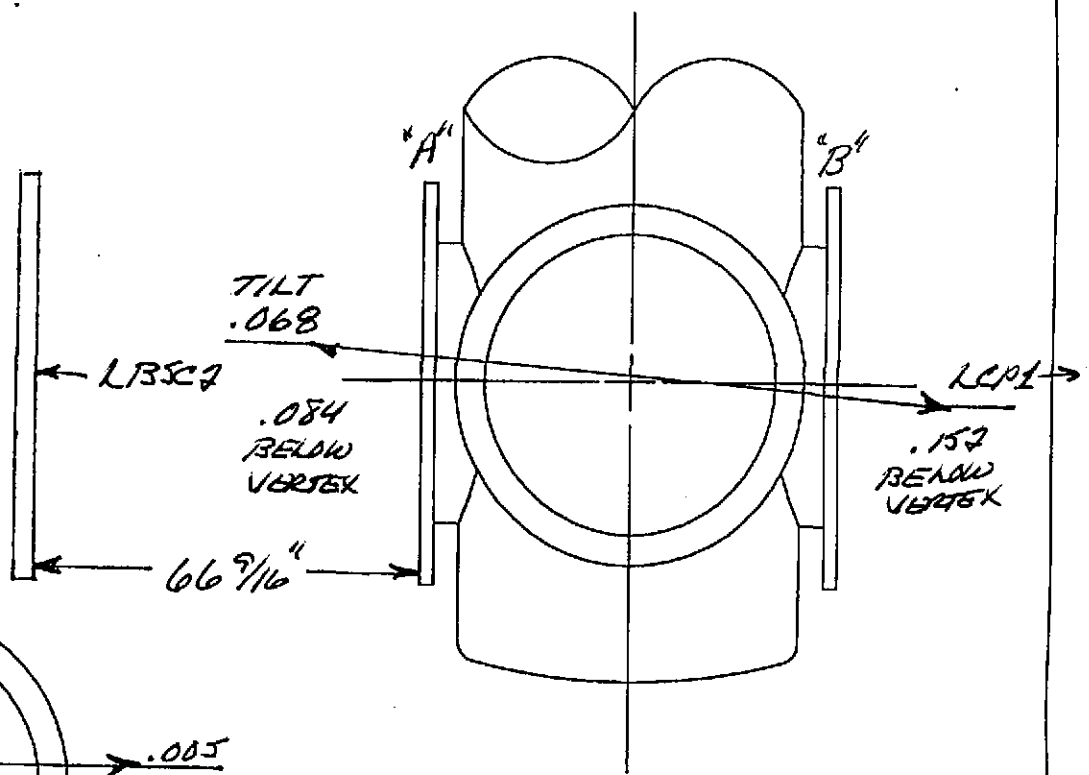
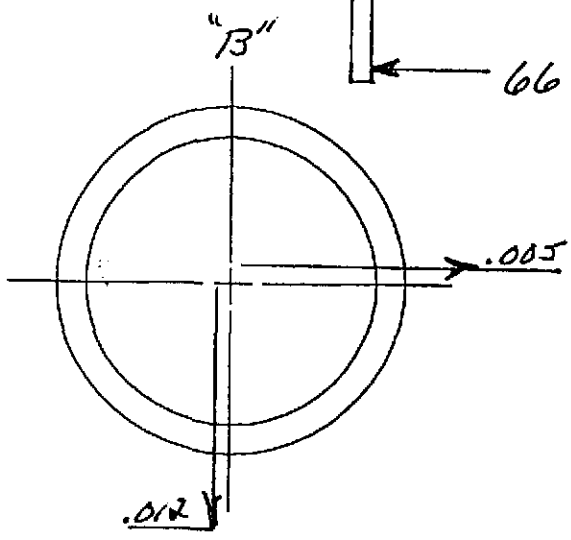
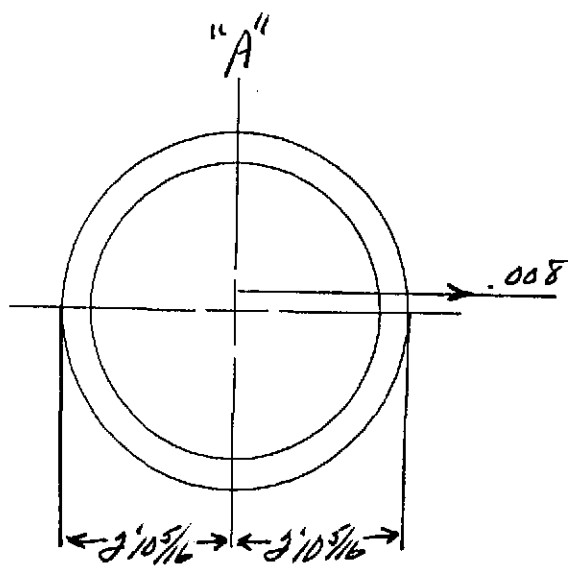


Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	TAS	27 JUNE 98
2. Component Located For Anchor Bolt Marking	TAS	27 JUNE 98
	Buyer ME	27 JUN 98
3. Final Component Location Complete	TAS	30 JUNE 98
	Buyer ME	30 JUN 98

SPECIFICATION

Number: A V049-2-174	Rev. 2
-------------------------	-----------

BLDG NORTH
→



Component ID: LBSC1
 Serial No: S/W 011

	Title: BEAM SPLITTER INSTALLED POSITION	Job No: V55049
	Project: LIGO Equipment Set	Scale: None Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 26 JUN 98	
Item Anchored: LBSC-1 S/N 11	No. of Anchors: 16	Size: 1"	Type: HAS-STA

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	MS		27 JUN 98
Spacing & Location	TBS	MS		
Anchor Size & Length 1" x 15"	TBS	MS		
Hole Size 1 1/8"	TBS	MS		
Hole & Core Condition (no voids, etc.)	TBS	MS		
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	MS		
Angle (90 deg. ± 1deg.)	TBS	MS		
Floor Scarified	TBS	MS		29 JUN 98
Proper Nut Engagement	TBS MS	MS		29 JUN 98
Tightening	TBS MS	MS		28 AUG 98

Torque Device Identification: AP-9 250 FT.LBS

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by:	Date: 26 JUN 98
----------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LBSC-1

Component Name:

BEAM SPLITTER - CORNER STA. LEFT ARM

Component S/N:

S/N 11

Vacuum Sealing Surfaces Inspection

By:

VBS 30 JUNE 98

Buyer:

JME 30 JUN 98

Cleanliness Inspection

By:

VBS 30 JUNE 98

Buyer:

JME 30 JUN 98

O-Rings Installed

By:

VBS 30 JUNE 98

Buyer:

JME 30 JUN 98

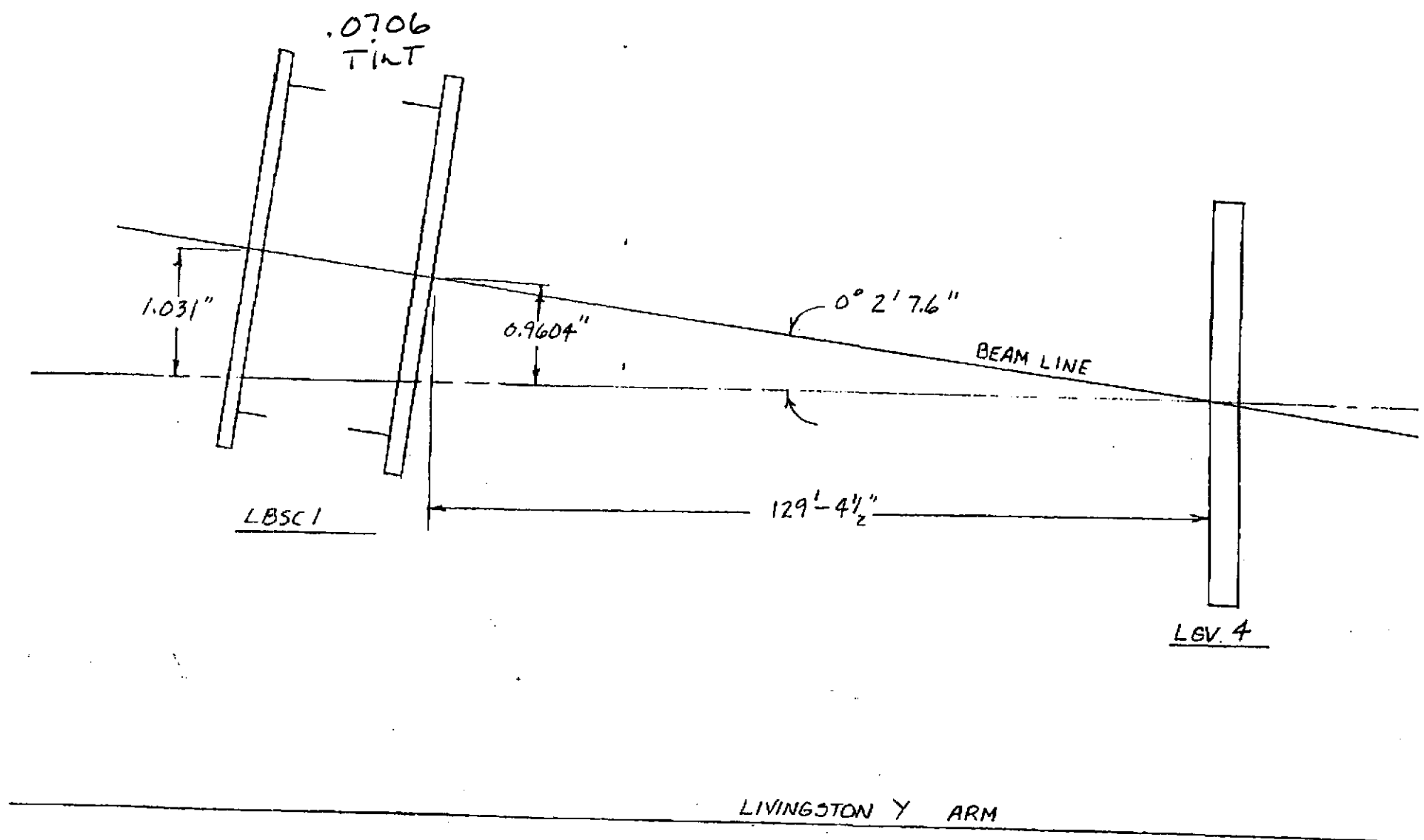
Bolt Torque

By:

VBS 8-1-98

Comments:

Rework Required:



TUE

DATE

6/30/98 CORNER ST

PAGE #

720

BSC-1 FINAL

SOUTH FLANGE ELEVATION
CALC: .147" BELOW VERTEX

.005" LOW

MEAS .152" BELOW VERTEX

NORTH FLANGE

.076" BELOW VERTEX

.008 LOW

.084" BELOW VERTEX

TILT CALC: .071"

ACT: .069"

SOUTH FLANGE &

.012" EAST

DUAL BOBS NORTH FLG

2'10 5/16 ± .010

ENDS: BSC-2-1 : 66 1/2"
CALC: 669/10

— bought two pairs of
RUBBER GLOVES.

DAVE EVERS INSPECTED
AND OK'ED FOR ASSEMBLY

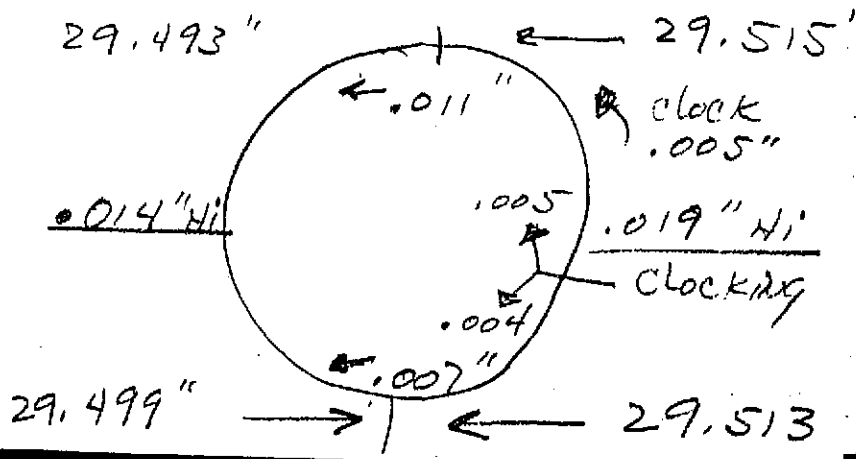
SAT
DATE 6/27/88 CORNER ST.

PAGE # 71⁰

BSC-1 PRE BOLT
66 9/16" BETWEEN BSC-2 & 1
DUAL BOBS BOTH ENDS
(NORTH & SOUTH) 2' 10 1/4" ± .010

SET SPOOL PIECE LA#3A
WEST FLANGE BSC-3 FOR
GATE VALVE.
MOVED CLEAN ROOM

SHOT GV-4 FOR ϕ &
ELEVATION

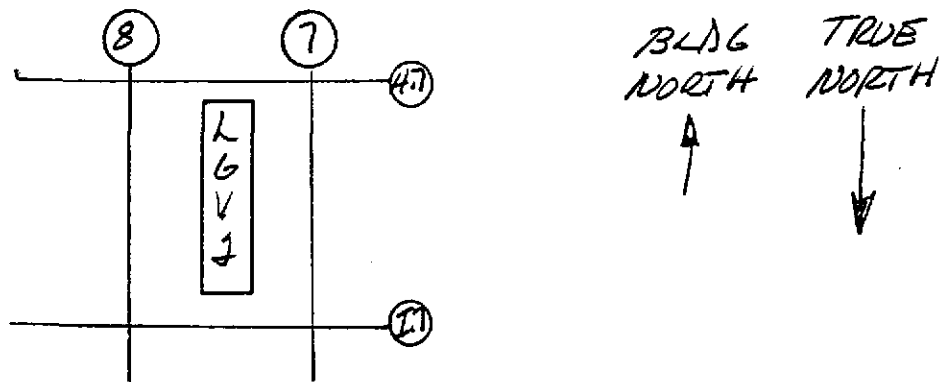


Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LGV 7
 Component Name RIGHT BEAM MANIFOLD 48" GATE VALVE
 Component S/N 51W 98
 Component Installation Weight (lb.) 7300 #

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	JTS	29 JUNE 98
	Buyer: MUE	29 JUNE 98
3. Final Component Location Complete	JTS	8-14-98
	Buyer: MUE	14 AUG 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev: 3	Date: 29 JUN 98	
Item Anchored: LGV 2 SUPPORT	No. of Anchors: 2	Size: 3/4"	Type: HAS-STA

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super)	TBS	YES	3	29 JUN 98	
Spacing & Location	TBS	YES		↓	
Anchor Size & Length 3/4" x 13 3/8"	TBS	YES			
Hole Size 7/8"	TBS	YES			
Hole & Core Condition (no voids, etc.)	TBS	YES			
Embedment (minus 0 plus 1/8") 6 3/8"	TBS	YES			
Angle (90 deg. ± 1 deg.)	TBS	YES			
Floor Scarified	TBS	YES			30 JUN 98
Proper Nut Engagement		YES			14 AUG 98
Tightening		YES			14 AUG 98

Torque Device Identification: AP-9 250 FT LB

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: *[Signature]*

Date: 29 JUN 98

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

26V2

Component Name:

RIGHT BEAM MANIFOLD 48" GATE VALVE

Component S/N:

5/1038

Vacuum Sealing Surfaces Inspection

By:

JTS 8-14-98

Buyer:

JUS 14 AUG 98

Cleanliness Inspection

By:

JTS 8-14-98

Buyer:

JUS 14 AUG 98

O-Rings Installed

By:

JTS 8-14-98

Buyer:

JUS 14 AUG 98

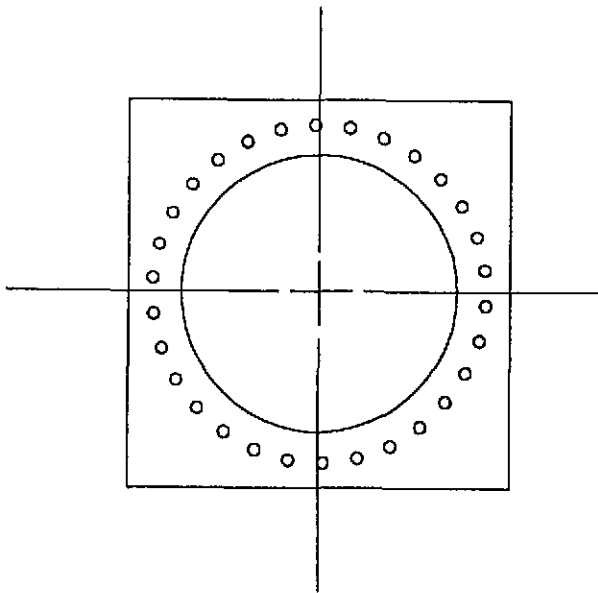
Bolt Torque

By:

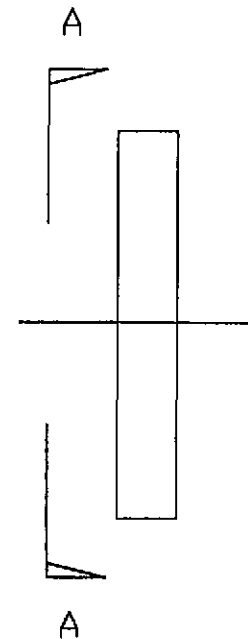
JTS 8-14-98

Comments:

Rework Required:



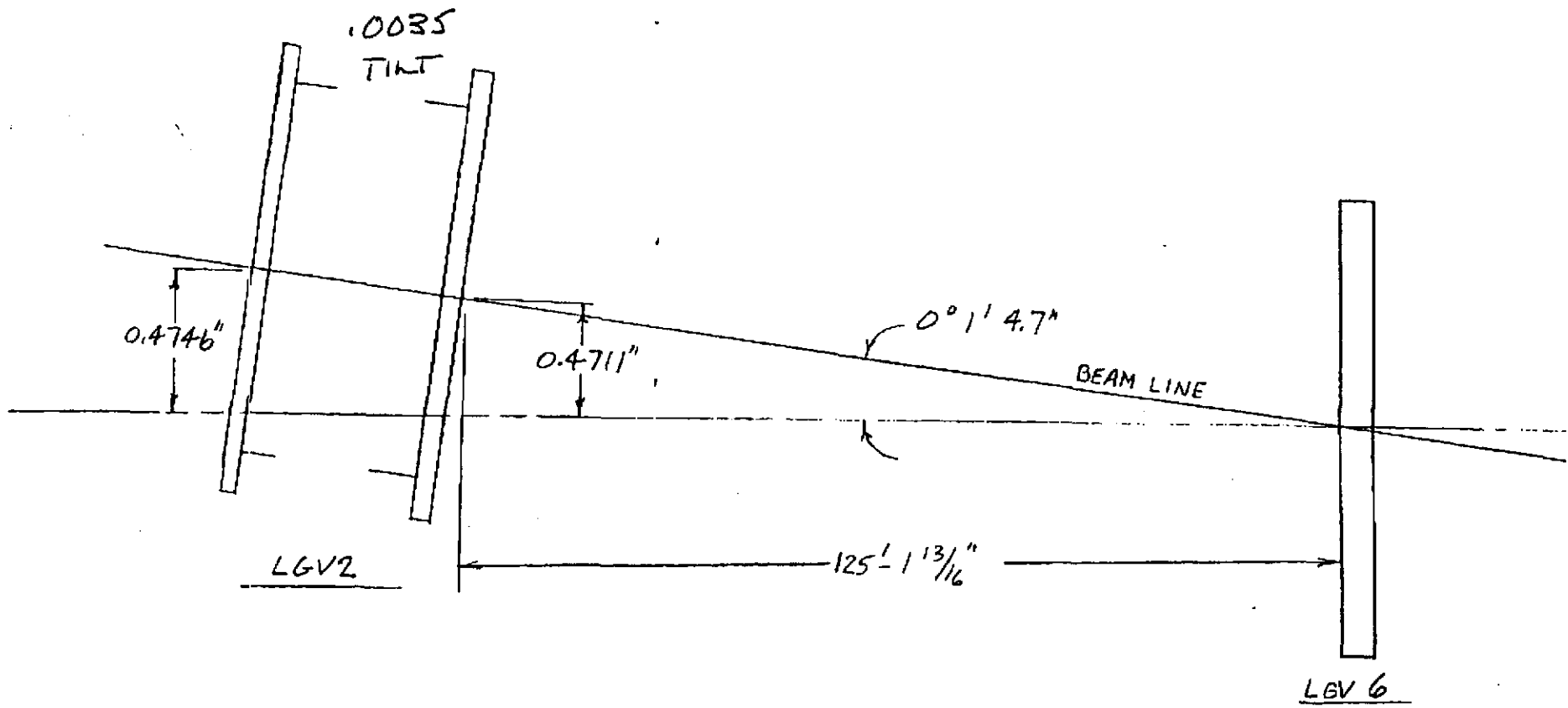
A-A



Component ID: LGV-2
 Serial No.: 5/1288

NO CENTERING MARKS ON
 VALVE. INSTALLED SAME AS
 LGV-1, PER ALLEN SIEBLY.
 ALL BOLTS INSTALLED BY HAND.

Title:	GATE VALVE INSTALLED POSITION	Job No.:	V59049
Project:	LIGO Equipment Set	Scale:	None
		Dwn By:	



.0035
TINT

0.4746"

0.4711"

0° 1' 4.7"

BEAM LINE

LG V2

125 - 1 13/16"

LG V 6

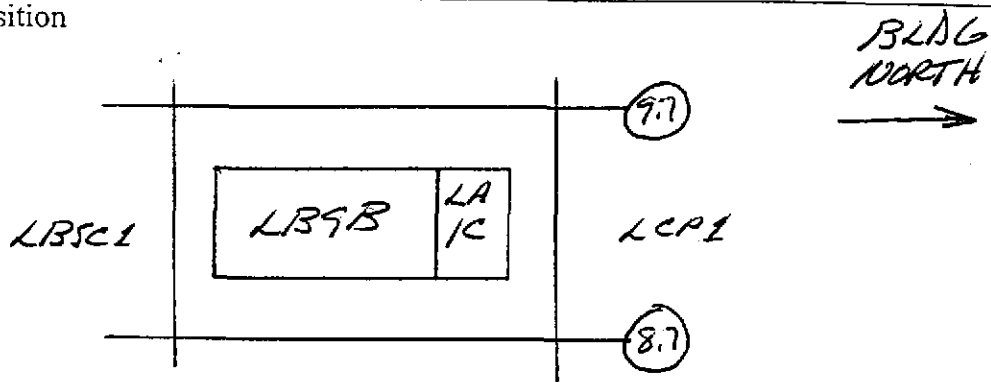
LIVINGSTON X ARM

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB9B / LA1C
 Component Name LEFT BEAM MANIFOLD ASSY.
 Component S/N S/N 04 / S/N 09
 Component Installation Weight (lb.) 10500#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>JTS</i>	11 July 98
2.	Component Located For Anchor Bolt Marking	<i>JTS</i>	17 July 98
		Buyer <i>JWS</i>	11 JUL 98
3.	Final Component Location Complete	<i>JTS</i>	13 July 98
		Buyer <i>JWS</i>	13 JUL 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev: V049-5-003 REV3	Date: 8 JUL 98	
Item Anchored: LB9B/LA1C	No. of Anchors: 30	Size: 1/4	Type:

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (FAS Std or Super)	TSS	NUS		8 JUL 98
Spacing & Location	TSS	NUS		
Anchor Size & Length 1/4 x 1.5	TSS	NUS		
Hole Size 1/8"	TSS	NUS		
Hole & Core Condition (no voids, etc.)	TSS	NUS		
Embedment (minus 0 plus 1/8") 6/4	TSS	NUS		
Angle (90 deg. ± 1deg.)	TSS	NUS		
Floor Scarified	TSS	NUS		
Proper Nut Engagement	TSS	NUS		
Tightening	TSS	NUS		8 JUL 98

Torque Device Identification: AP-9 250/400

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:
 SUPER ANCHOR BOLTS USED ON DIAGONAL TRACES
 PADS ONLY

Inspection by: <i>NUS</i>	Date: 8 JUL 98
---------------------------	----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LB9B / LAIC

Component Name: LEFT BEAM MANIFOLD SPOOL

Component S/N: S/N 04 / S/N 09

Vacuum Sealing Surfaces Inspection

By: TBS 13 JULY 98

Buyer: JWE 13 JUL 98

Cleanliness Inspection

By: TBS 13 JULY 98

Buyer: JWE 13 JUL 98

-Rings Installed

By: TBS 13 JULY 98

Buyer: JWE 13 JUL 98

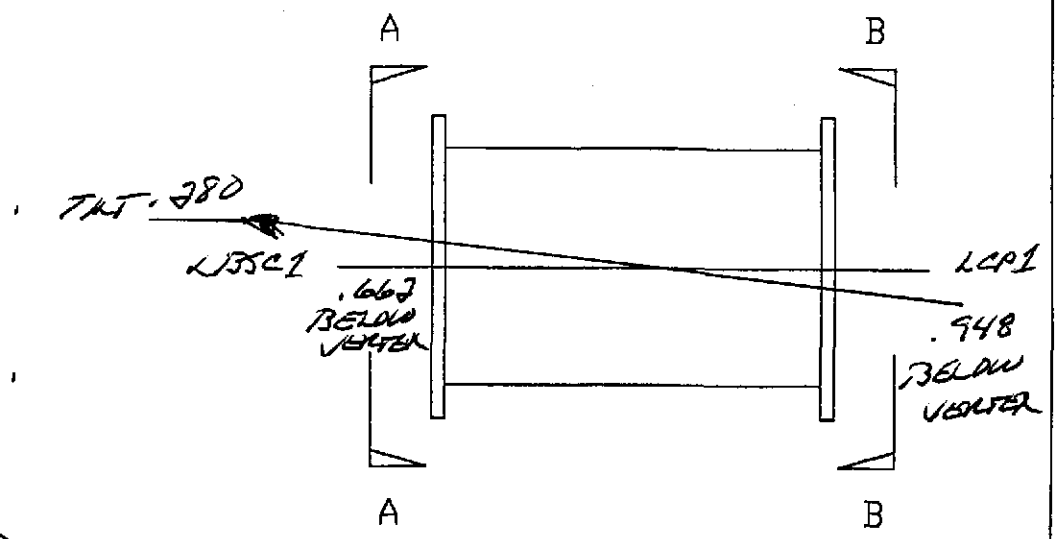
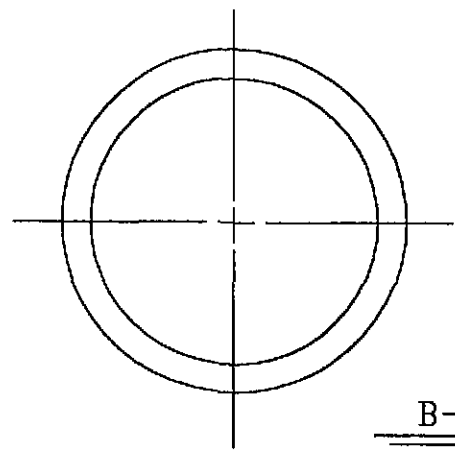
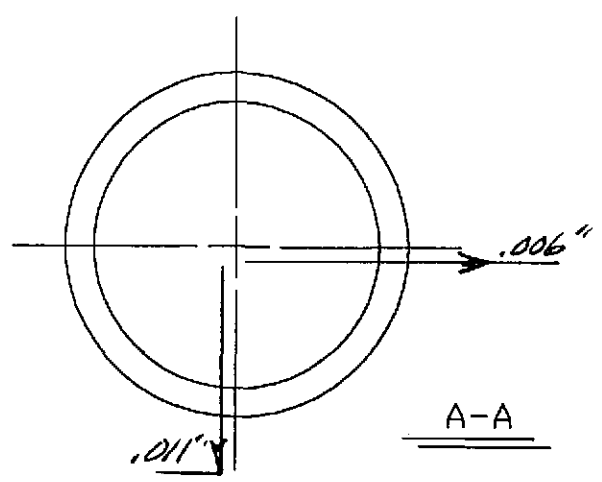
Bolt Torque

By: TBS 8-1-98

Comments:

Rework Required:

BLDG NORTH
→



Component ID: LBSB/LAIC
Serial No: 04/09

	Title: <u>SPOOL PIECE INSTALLED POSITION</u>	Job No: <u>V59049</u>	
	Project: <u>LIGO Equipment Set</u>	Scale: <u>None</u>	Dwn By:

Wed

DATE

7/8/98 CORNER ST

PAGE #

72°

WITA TO AIRPORT

SET LB-98 SPOOL FOR
PRE BOLT.

SOUTH FLANGE

$3' \geq \frac{3}{32}'' \pm .010$

NORTH FLANGE

.003 WEST OF ϕ

END $0 + \frac{1}{32}''$ LONG

TRIED TO PLACE GV-3
BUT TROLLEY ON CRANE
WOULDN'T GO.

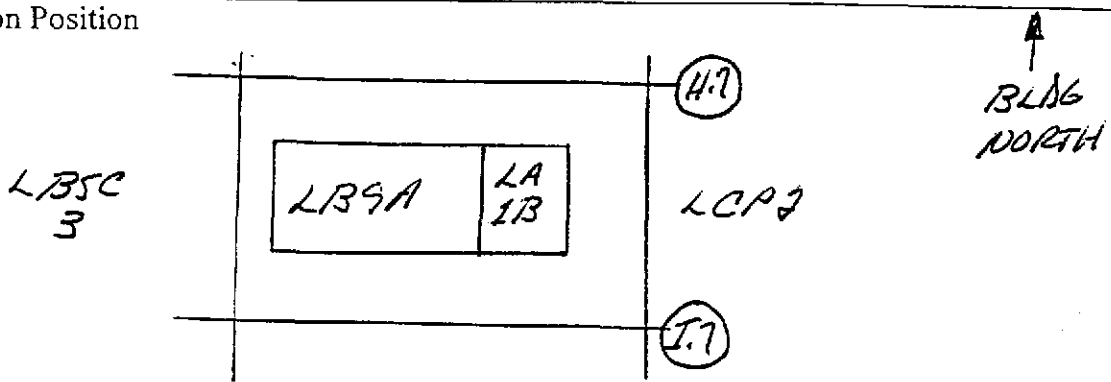
CLEAN SHOP.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB9A/LA1B
 Component Name RIGHT BEAM MANIFOLD SPOOK ASSEMBLY
 Component S/N S/N 03 / S/N 08
 Component Installation Weight (lb.) 10500#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>[Signature]</i>	11 JULY 98
2.	Component Located For Anchor Bolt Marking	<i>[Signature]</i>	11 JULY 98
	Buyer	<i>[Signature]</i>	11 JUL 98
3.	Final Component Location Complete	<i>[Signature]</i>	11 JULY 98
	Buyer	<i>[Signature]</i>	11 JUL 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LB9A/LA1B

Component Name: RIGHT BEAM MANIFOLD SPOOL ASSY.

Component S/N: S/N 03/S/N 08

Vacuum Sealing Surfaces Inspection

By: TBS 14 JULY 98

Buyer: NUS 14 JUL 98

Cleanliness Inspection

By: TBS 14 JULY 98

Buyer: NUS 14 JUL 98

O-Rings Installed

By: TBS 14 JULY 98

Buyer: NUS 14 JUL 98

Bolt Torque

By: TBS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 13 JUL 98	
Item Anchored: LB9A/LAIR	No. of Anchors 30	Size: 1"	Type: HAS/SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or <u>Super</u>)	TJS	<input checked="" type="checkbox"/>		13 JUL 98
Spacing & Location	TJS	<input checked="" type="checkbox"/>		
Anchor Size & Length 1 X 1.5	TJS	<input checked="" type="checkbox"/>		
Hole Size 1-1/8	TJS	<input checked="" type="checkbox"/>		
Hole & Core Condition (no voids, etc.)	TJS	<input checked="" type="checkbox"/>		
Embedment (minus 0 plus 1/8") 8/4	TJS	<input checked="" type="checkbox"/>		
Angle (90 deg. ± 1deg.)	TJS	<input checked="" type="checkbox"/>		
Floor Scarified	TJS	<input checked="" type="checkbox"/>		
Proper Nut Engagement	TJS	<input checked="" type="checkbox"/>		
Tightening		<input checked="" type="checkbox"/>		3 AUG 98

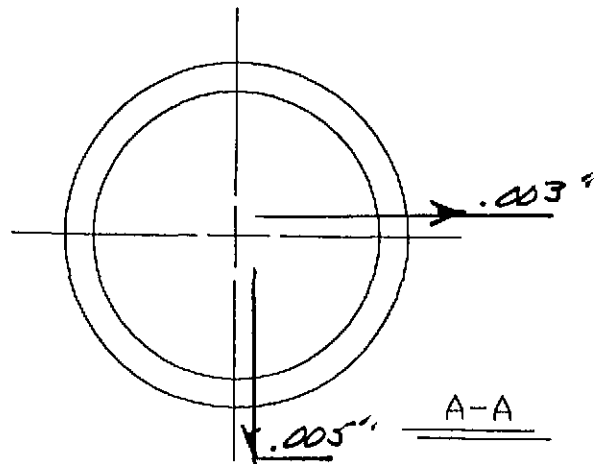
Torque Device Identification: AP-9 250/400
Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

SUPER ANCHOR BONTS USED ON DIAGONAL BRACE PANS ONLY

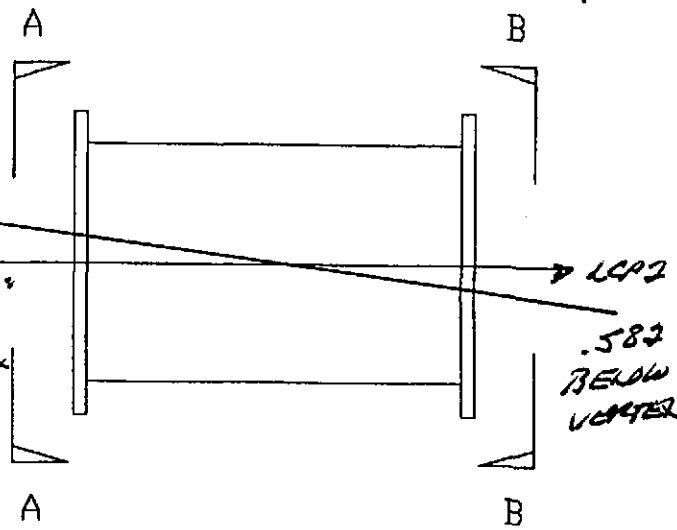
Inspection by: <u>TJS</u>	Date: 13 JUL 98
---------------------------	-----------------



A-A

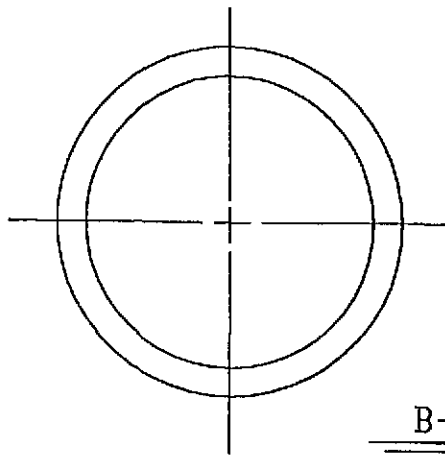
THT .188"

← LBSC3
 .394"
 BELOW
 CENTER



→ LCP2
 .582"
 BELOW
 CENTER

BLDG
 NORTH
 ↑



B-B

Component ID: LB5A/LA1B

Serial No: 03/08

	Title: SPOOL PIECE INSTALLED POSITION	Job No: V59049	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

LB-9A FINAL

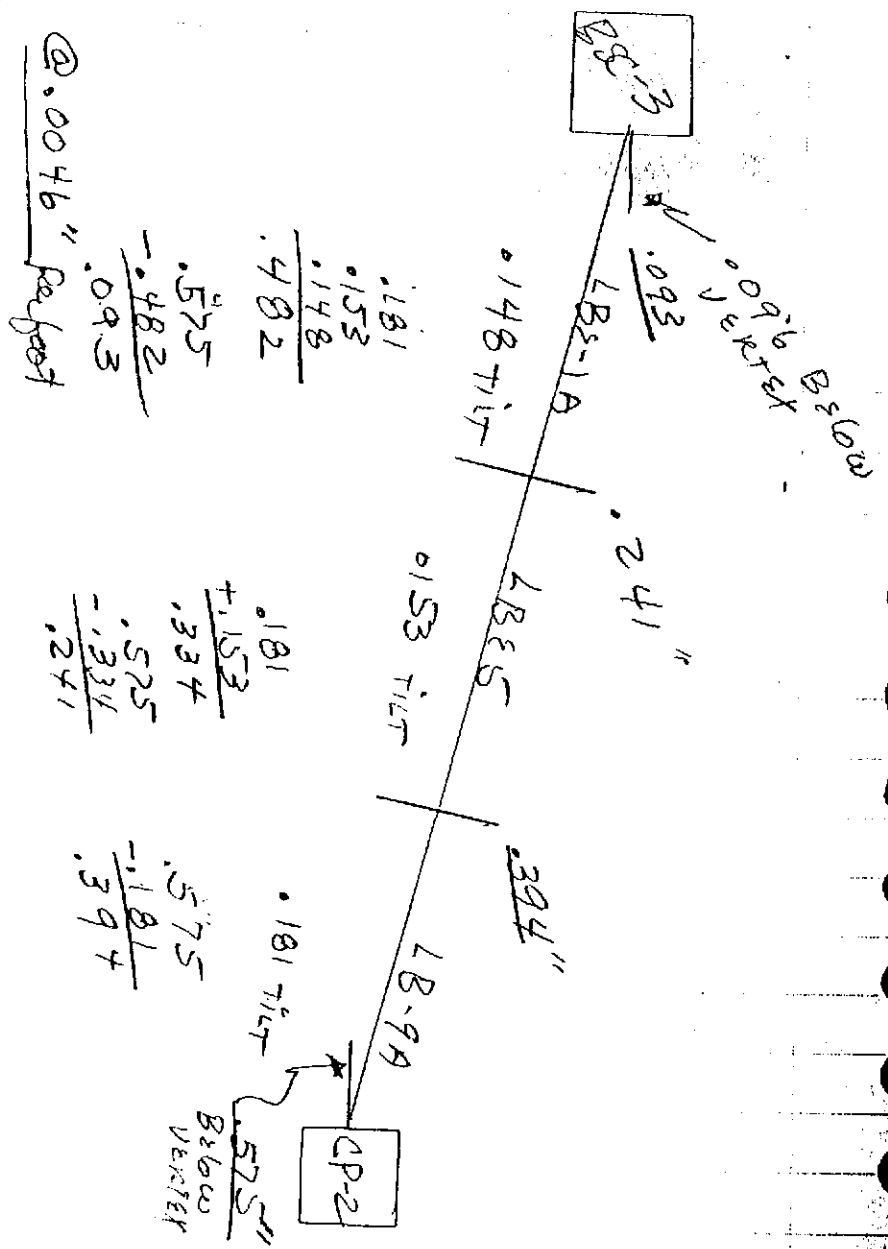
EAST FLANGE ϕ
 .005 NORTH OF ϕ

ELEV: .003" LOW
 .394 Below VERTEX

LB-6 FINAL
 NORTH FLANGE ϕ
 .007 WEST OF ϕ

ELEV: CALC: .420
 .004 LOW Below VERTEX

.0046" PER FOOT



DATE 7-11-78 CORNER ST

PAGE # 740

LB-9A PRE BOLT

EAST FLANGE $\frac{1}{2}$
.018" NORTH OF $\frac{1}{2}$
DUAL BOBS WEST END.
3'4 $\frac{1}{4}$ " \pm .015

ENDO $\frac{1}{8}$ " SHORT

MONDAY

DATE 7/13

CORNER ST

PAGE # 980

PRE BOLT
LB-9A

EAST FLANGE
.018 NORTH of ϕ
DUAL BOBS
3'4 $\frac{1}{4}$ " \pm .010
ENDO $\frac{1}{8}$ SHORT

MOVED LB-9A &
DRILLED & PLACED
ANCHOR BOLTS. SCARIFIED
FLOOR.

LB-6
DRILLED BOLTS
& SCARIFIED FLOOR
RE SET LB-6

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LIP #6 (RT. END STA.)

Component Name: 3500 L/S 10W PUMP

Component S/N: _____

Vacuum Sealing Surfaces Inspection

By: [Signature] 28 MAY 98

Buyer: [Signature] 28 MAY 98

Cleanliness Inspection

By: [Signature] 28 MAY 98

Buyer: [Signature] 28 MAY 98

Rings Installed

By: [Signature] 28 MAY 98

Buyer: [Signature] 28 MAY 98

Bolt Torque

By: [Signature] 8-3-98

Comments:

Rework Required:

MON.

DATE 5/10/98

RIGHT END ST

PAGE # 71⁰

SET SPOOL PIECE BETWEEN
VALVE & B.S.

BOLTED LEGS, SCARIFIED
FLOOR. SET 14" GATE VALVE & I.D. 6

* MUST BLEED VACUUM TO
GET LOWER FLANGE COVER
OFF. ELECTRICAL HOOKUP
PARALLEL TO BEAM LINE AND

PUMP OUT PORT TOWARD
VALVE OPERATOR (HAND
WHEEL) ON ION PUMP.

STUTS ARE $3/8"$ X $2 1/4$ FINE
THREAD.

* NOTE NO TORQUE ON FLANGE
BOLTS AT THIS STATION.

RIPPED 14" VALVE WITH 4 (FOUR)
EYE BOLTS & SLINGS.

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LIP 5 (LFT. END STA.)

Component Name:

2500 L/S 10W PUMP

Component S/N:

Vacuum Sealing Surfaces Inspection

By:

TBS 25 July 98

Buyer:

NLS 25 JUL 98

Cleanliness Inspection

By:

TBS 25 July 98

Buyer:

NLS 25 JUL 98

Rings Installed

By:

TBS 25 July 98

Buyer:

NLS 25 JUL 98

Bolt Torque

By:

TBS 8-3-98

Comments:

Rework Required:

SAT. DATE 7-25-78 CORNER ST

PAGE # 8

SET 14" VALUE &
ION PUMP I.P.-5.

BROKE DOWN & MOVED
TOOLS BACK TO CORN
STATION.

SET 6" VALUE ON
LBE-5 ON 'A' LEG.

WORKED GREAT FORM.

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LIP 1 (LR3A)

Component Name: 3500 L/S 10W PUMP

Component S/N: _____

Vacuum Sealing Surfaces Inspection

By: JTS 22 JUNE 98

Buyer: MS 22 JUN 98

Cleanliness Inspection

By: JTS 22 JUNE 98

Buyer: MS 22 JUN 98

Rings Installed

By: JTS 22 JUNE 98

Buyer: MS 22 JUN 98

Bolt Torque

By: JTS B-4-98

Comments:

Rework Required:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LIP2 (LR3A)

Component Name:

3500 H/S 10W PUMP

Component S/N:

Vacuum Sealing Surfaces Inspection

By:

VTSS 22 JUNE 98

Buyer:

WSE 22 JUN 98

Cleanliness Inspection

By:

VTSS 22 JUNE 98

Buyer:

WSE 22 JUN 98

O-Rings Installed

By:

VTSS 22 JUNE 98

Buyer:

WSE 22 JUN 98

Bolt Torque

By:

VTSS 8-4-98

Comments:

Rework Required:

NOTE A 40° offset groove.

WE USED PLASTIC
WEDGES, NICKEL & BRASS
WITH ANCHOR ELBOW
PLEASE TO REMOVE THE
MATERIAL.

LOOKED OK WHEN
ASSEMBLED. WE HAVE
USED NICKEL BUT
THE PLASTIC WEDGES
→ LEAN THE GROOVE.

A/C OFF AT 3:00 PM
AGAIN AT 78° IN BUILDING

MON

DATE 6/22/88

CORNER

PAGE # 71

SET 14" GATE VALVES AND
ION PUMPS 1 & 2.
MOVED CLEAN ROOM

DRILLED & BOLTED
SUPPORT LEGS. LB-3A

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

L1P3 (L135A)

Component Name:

2500 4/5 10N POMP

Component S/N:

Vacuum Sealing Surfaces Inspection

By:

JTS

24 JUNE 98

Buyer:

ME

24 JUN 98

Cleanliness Inspection

By:

JTS

24 JUNE 98

Buyer:

ME

24 JUN 98

O-Rings Installed

By:

JTS

24 JUNE 98

Buyer:

ME

24 JUN 98

Bolt Torque

By:

JTS

8-3-98

Comments:

Rework Required:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: L1P4 (LB5A)

Component Name: 3500 L/S 10W PUMP

Component S/N: _____

Vacuum Sealing Surfaces Inspection

By: TSS 24 JUNE 98

Buyer: NS 24 JUN 98

Cleanliness Inspection

By: TSS 24 JUNE 98

Buyer: NS 24 JUN 98

O-Rings Installed

By: TSS 24 JUNE 98

Buyer: NS 24 JUN 98

Bolt Torque

By: TSS 8-1-98

Comments:

Rework Required:

Wed

DATE 6/24/88 CORNER ST

PAGE # 71

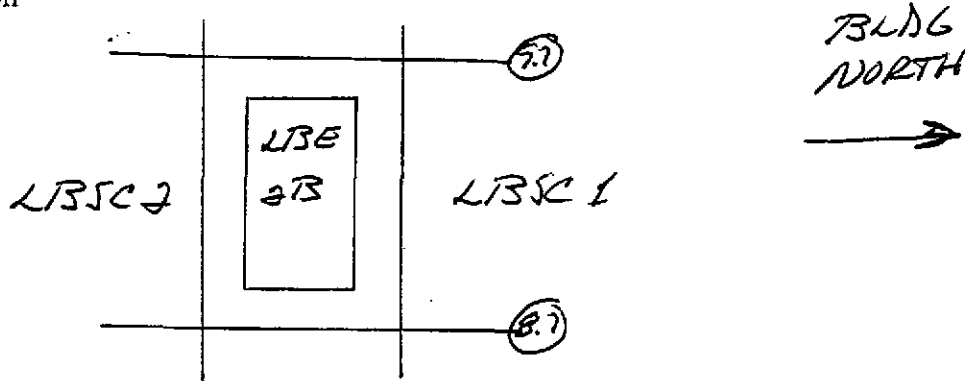
SET 14" GATE VALVES
& ION PUMPS 3 & 4.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB3 JB
 Component Name LEFT BEAM MANIFOLD SPOOL
 Component S/N 5/10 04
 Component Installation Weight (lb.) 6800#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	JCS	6-30-98
	Buyer	NSE	JUNE 30 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBE JB

Component Name: LEFT BEAM MANIFOLD SPOOL

Component S/N: S/N 04

Vacuum Sealing Surfaces Inspection

By: JTS JUNE 30 98

Buyer: JMS

Cleanliness Inspection

By: JTS JUNE 30 98

Buyer: JMS

-Rings Installed

By: JTS JUNE 30 98

Buyer: JMS

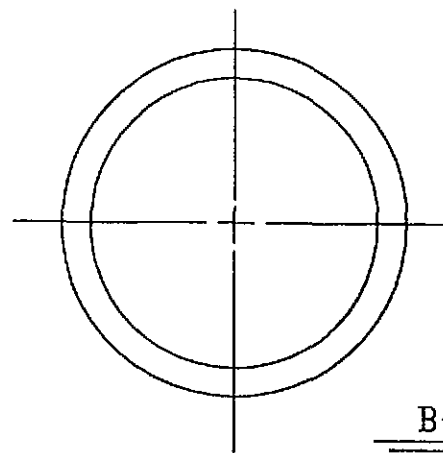
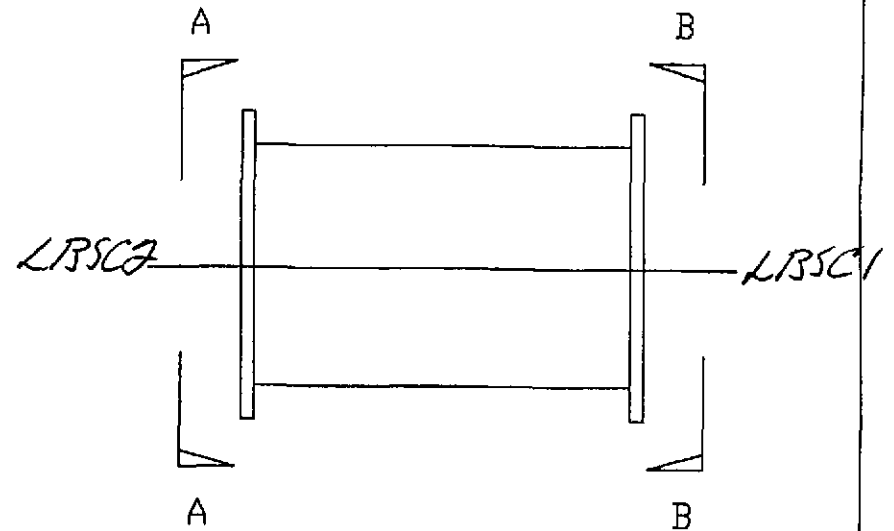
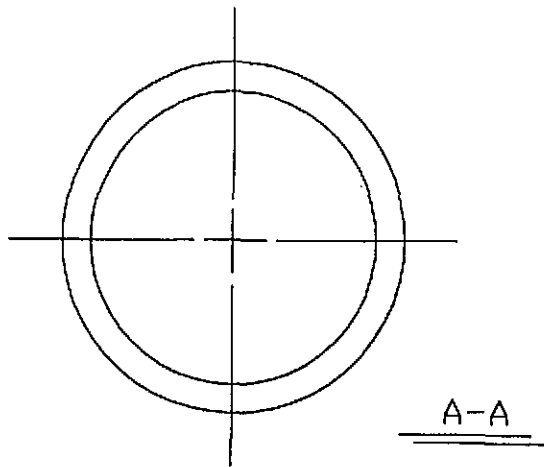
Bolt Torque

By: JMS JTS 8-1-98

Comments:

Rework Required:

BLNG NORTH



NO ALIGNMENT
REQUIRED

Component ID:

LRBE 2B

Serial No.:

S/N OM

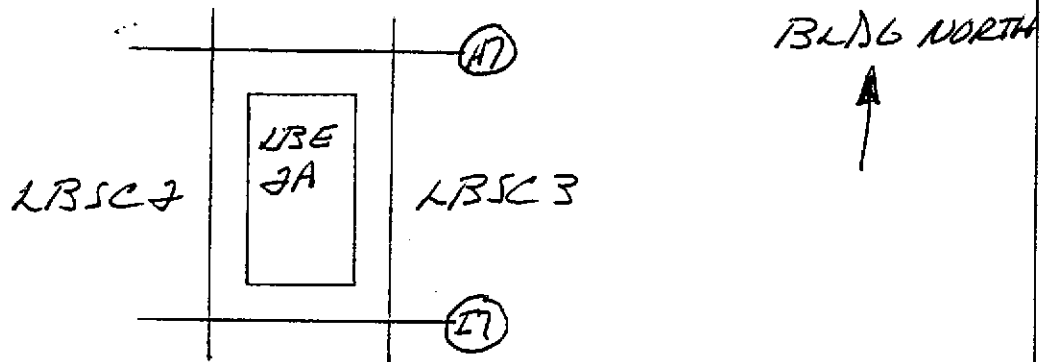
	Title: SPDOL PIECE INSTALLED POSITION	Job No.: V55048
	Project: LIGO Equipment Set	Scaler: None Dwn By:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBESA
 Component Name RIGHT BEAM MANIFOLD SPOOL
 Component S/N 5/10 01
 Component Installation Weight (lb.) 6800#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	N/A	
	Buyer N/A	
3. Final Component Location Complete	STBS	25 JUNE 98
	MS	25 JUNE 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBE 2A

Component Name: RIGHT BEAM MANIFOLD SPOOK

Component S/N: S/W 01

Vacuum Sealing Surfaces Inspection

By: TGS 25 JUNE 98

Buyer: MSE 25 JUN 98

Cleanliness Inspection

By: TGS 25 JUNE 98

Buyer: MSE 25 JUNE 98

-Rings Installed

By: TGS 25 JUNE 98

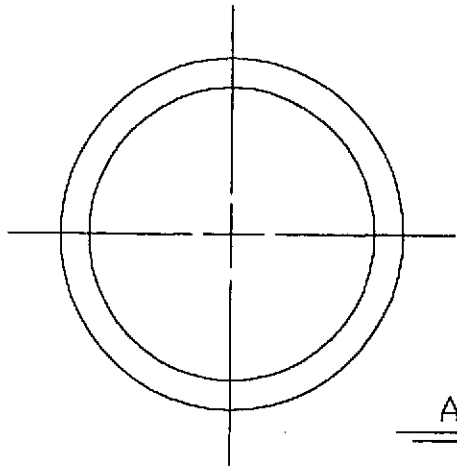
Buyer: MSE 25 JUNE 98

Bolt Torque

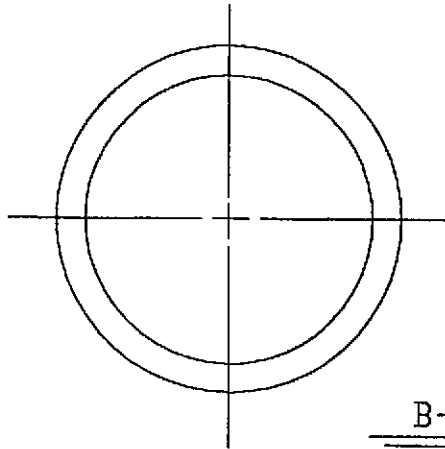
By: TGS 8-1-98

Comments:

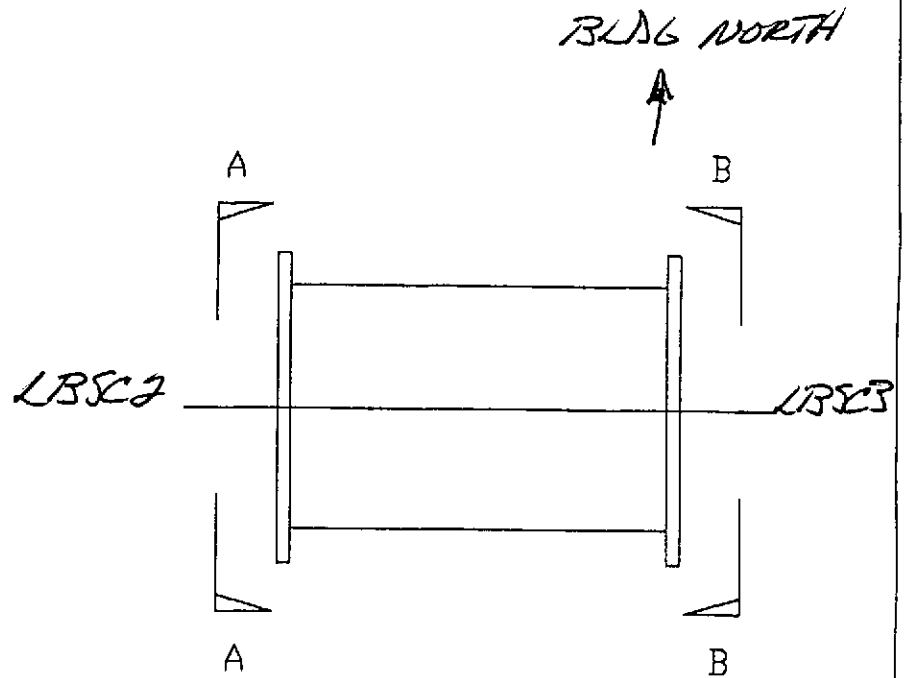
Rework Required:



A-A



B-B



*NO ALIGNMENT
REQUIRED*

Component ID: LBSC2A

Serial No.: 5/201

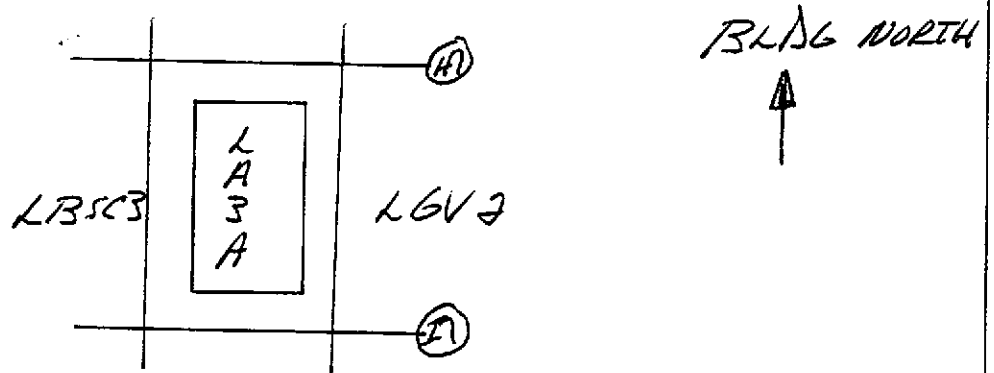
	Title: SPOOL PIECE INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA3A
 Component Name RIGHT BEAM MANIFOLD SPOOL
 Component S/N S/N 03
 Component Installation Weight (lb.) 6800#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	<i>[Signature]</i>	27 JUNE 98
	Buyer	<i>[Signature]</i>	27 JUN 98

SPECIFICATION

Number: A V049-2-174	Rev. 2
-------------------------	-----------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LA 3A

Component Name: RIGHT BEAM MANIFOLD SPOOL

Component S/N: 5/N 03

Vacuum Sealing Surfaces Inspection

By: TDS 27 JUNE 98

Buyer: WSE 27 JUNE 98

Cleanliness Inspection

By: TDS 27 JUNE 98

Buyer: WSE 27 JUNE 98

Rings Installed

By: TDS 27 JUNE 98

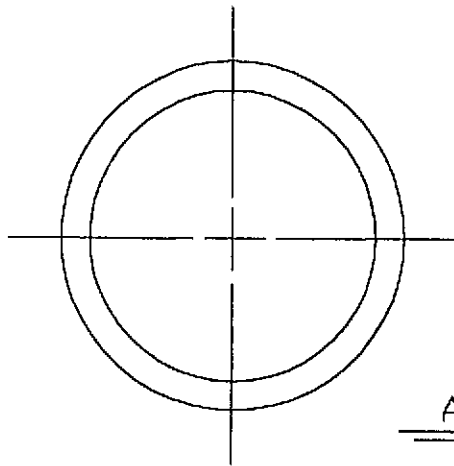
Buyer: WSE 27 JUNE 98

Bolt Torque

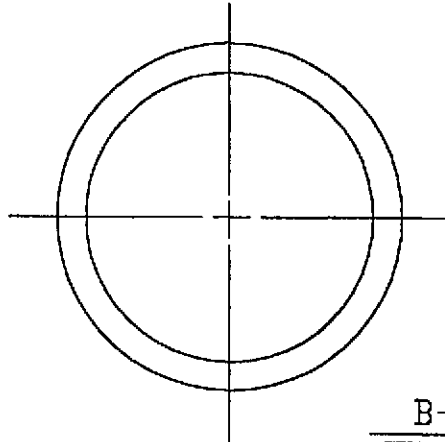
By: TDS 8-1-98

Comments:

Rework Required:

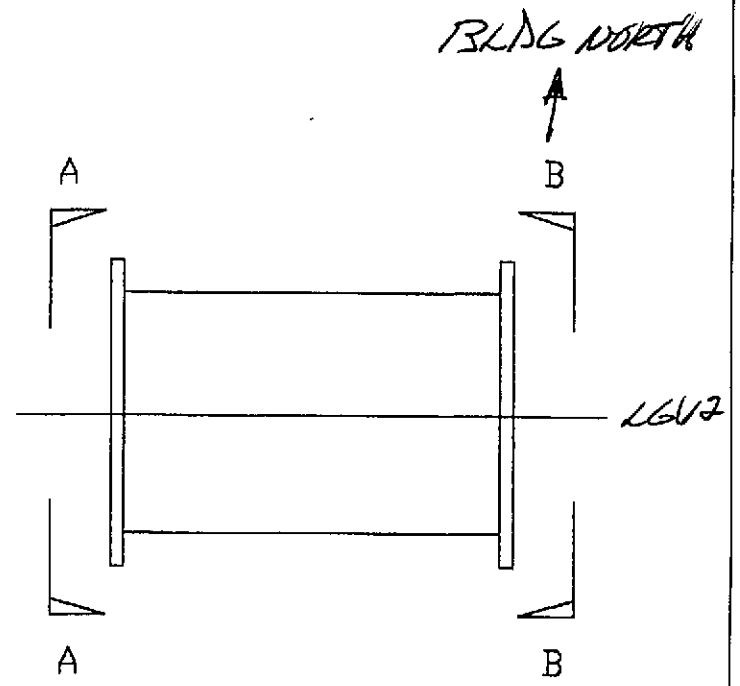


A-A



B-B

LRSC 3



LGV 7

Component ID: LA3-A
 Serial No.: 03

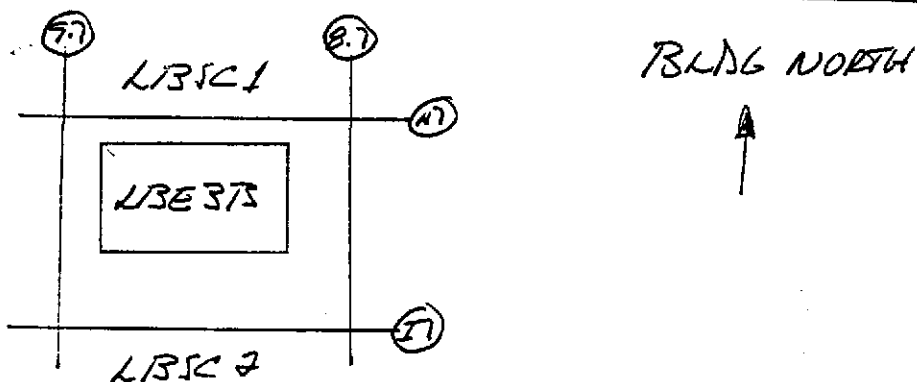
	Title: SPOOL PIECE INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBE 3B
Component Name LEFT BEAM MANIFOLD SPOOL
Component S/N S/N 03
Component Installation Weight (lb.) 2400 #

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	<i>[Signature]</i>	23 JUNE 98
	Buyer	<i>[Signature]</i>	23 JUNE 98

SPECIFICATION

Number: A V049-2-174 Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBE3B

Component Name: LEFT BEAM MANIFOLD SPOOL

Component S/N: S/N03

Vacuum Sealing Surfaces Inspection

By: TBS 23 JUNE 98

Buyer: MS 23 JUN 98

Cleanliness Inspection

By: TBS 23 JUNE 98

Buyer: MS 23 JUN 98

-Rings Installed

By: TBS 23 JUNE 98

Buyer: MS 23 JUN 98

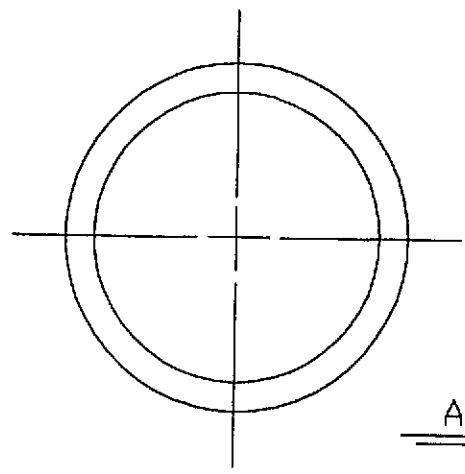
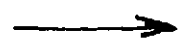
Bolt Torque

By: TBS 8-1-98

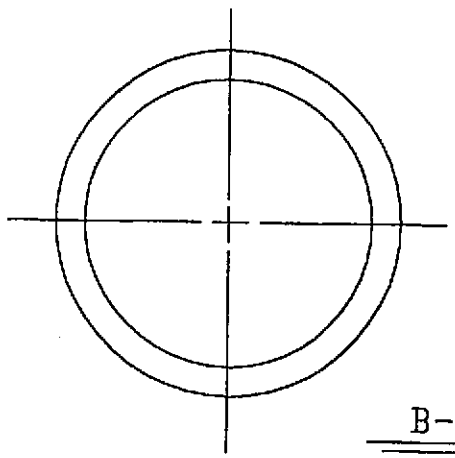
Comments:

Rework Required:

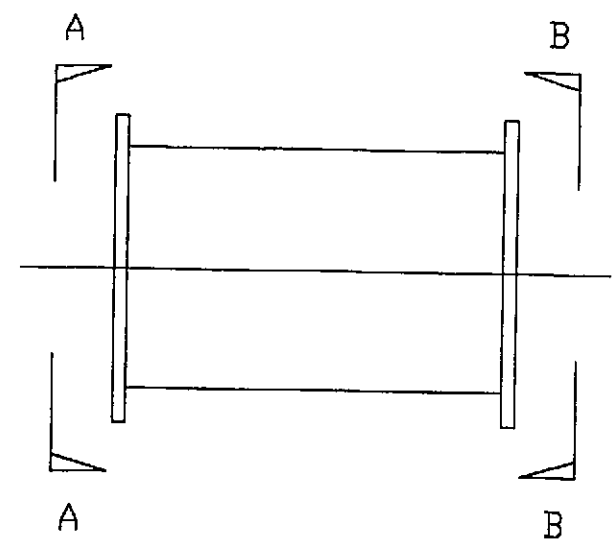
BLDG NORTH



A-A



B-B



NO ALIGNMENT
REQUIRED

Component ID: LBE 3B
Serial No.: 5/N 03

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: <u>V55049</u>
	Project: LIGD Equipment Set	Scale: <u>None</u> Dwn By:

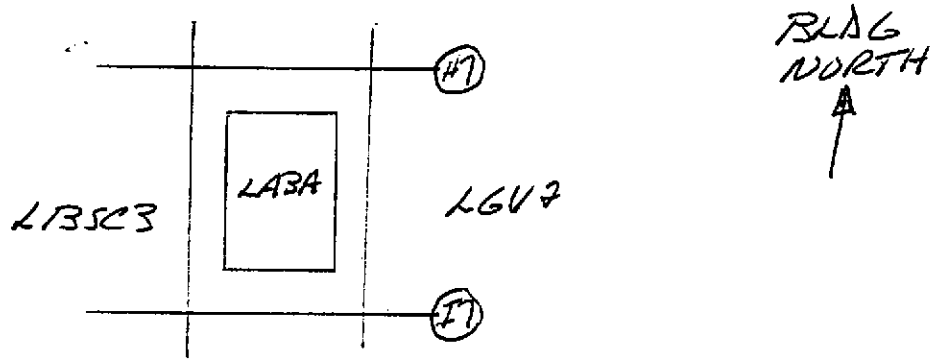
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA 3A
 Component Name RIGHT BEAM MANIFOLD SPOOL
 Component S/N S/N 03
 Component Installation Weight (lb.) 2400#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
3.	Final Component Location Complete	Buyer <u>JCS</u>	<u>27 JUNE 98</u>
		Buyer <u>JMS</u>	<u>27 JUN 98</u>

SPECIFICATION

Number:	Rev.
A V049-2-174	2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LA 3A

Component Name: RIGHT BEAM MANIFOLD SPOOL

Component S/N: 510 03

Vacuum Sealing Surfaces Inspection

By: JTS 27 JUNE 98

Buyer: JMS 27 JUNE 98

Cleanliness Inspection

By: JTS 27 JUNE 98

Buyer: JMS 27 JUNE 98

O-Rings Installed

By: JTS 27 JUNE 98

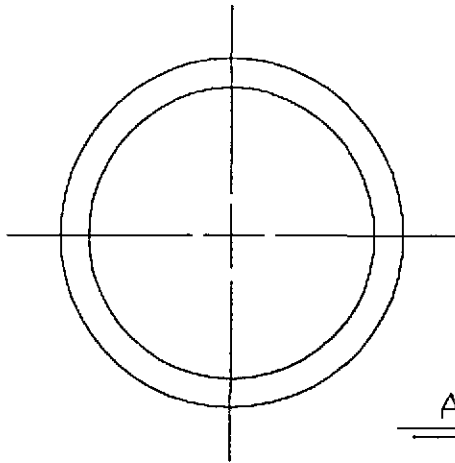
Buyer: JMS 27 JUNE 98

Bolt Torque

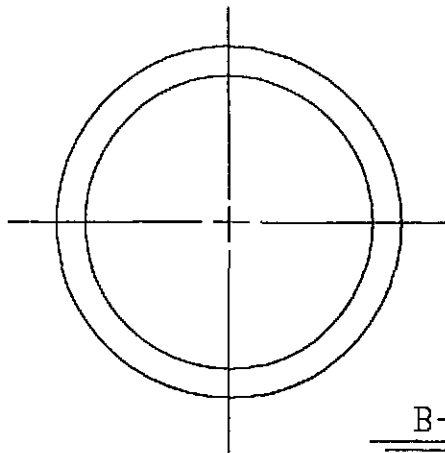
By: JTS 8-1-98

Comments:

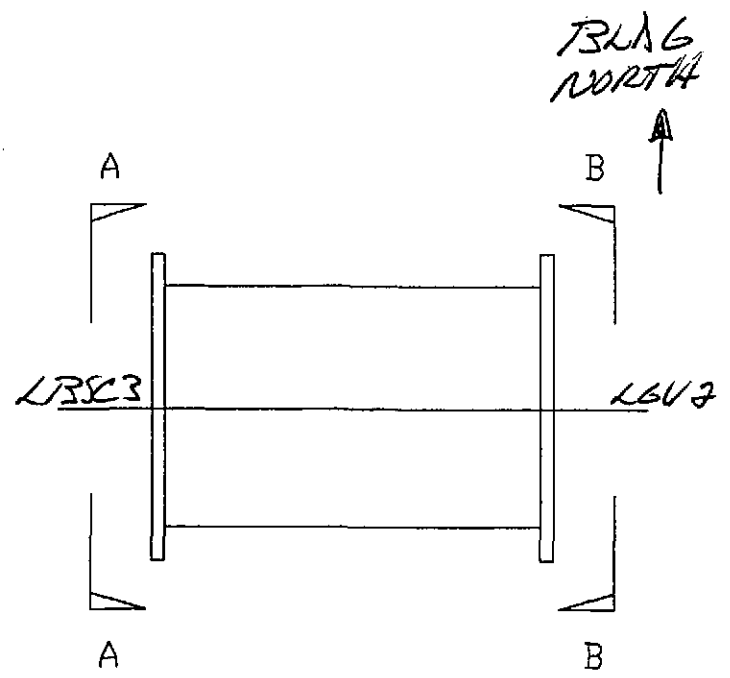
Rework Required:



A-A



B-B



NO ALIGNMENT
REQUIRED

Component ID: LA 3A
 Serial No.: 5/1003

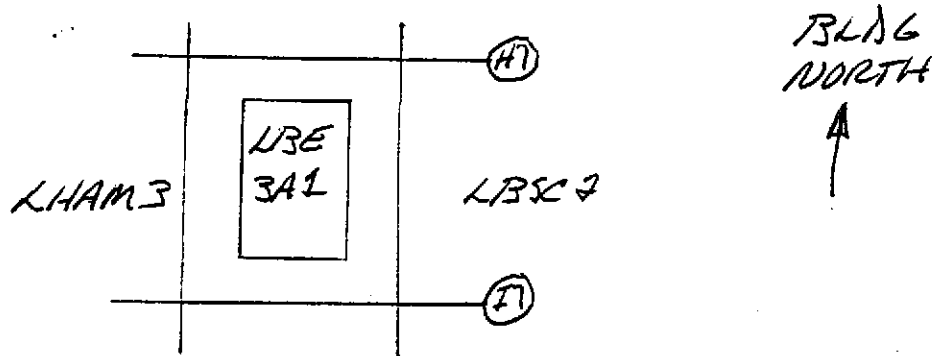
	Title: SPOOL PIECE INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB3A1
 Component Name RIGHT BEAM MANIFOLD SPOOL
 Component S/N S/W 03
 Component Installation Weight (lb.) 2400 #

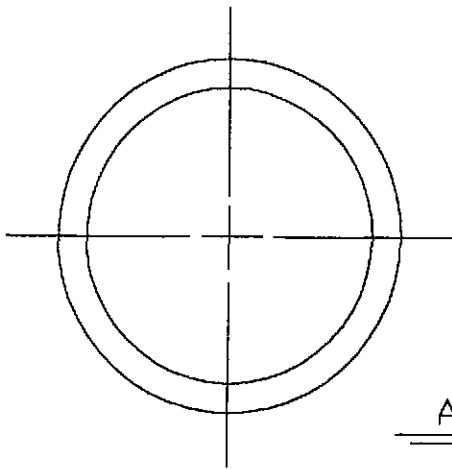
Component Installation Position
 (Ref. D Build Grid)



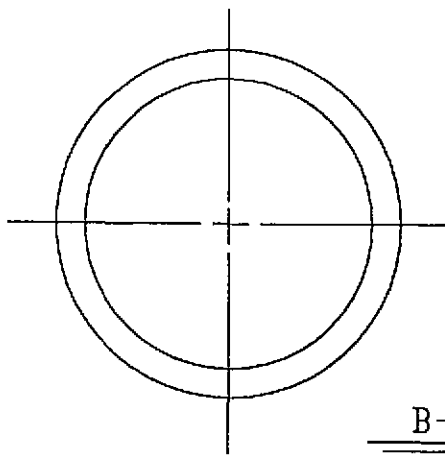
Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	JTS	20 JUL 98
	Buyer	JTS	20 JUL 98

SPECIFICATION

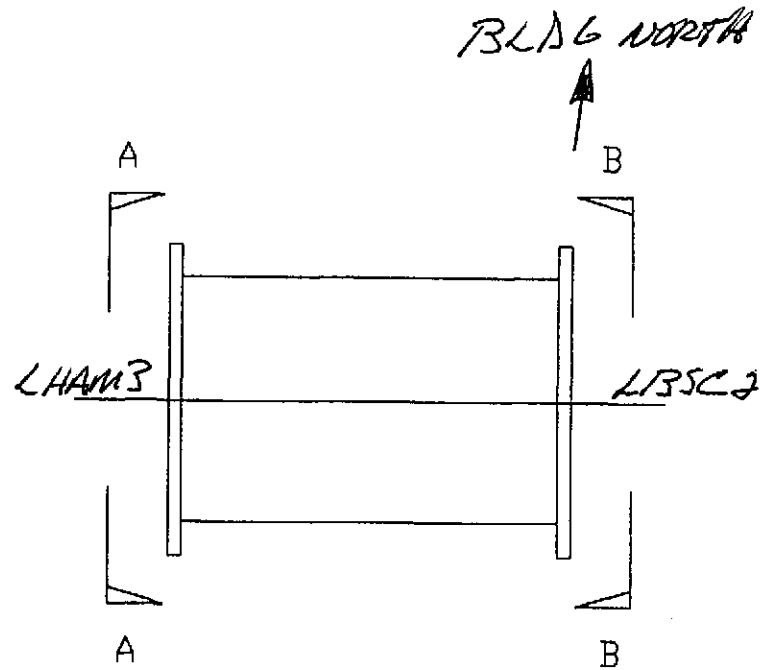
Number:	A V049-2-174	Rev.	2
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A-A



B-B



NO ALIGNMENT
REQUIRED

Component ID:

LBE-3A

Serial No.:

5/10 03

	Title: SPOOL PIECE INSTALLED POSITION	Job No.:	V59049
	Project: LIGO Equipment Set	Scale: None	Dwn By:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBE 3A1

Component Name: RIGHT BEAM MANIFOLD SPOOL

Component S/N: S/N 03

Vacuum Sealing Surfaces Inspection

By: TDS 20 JUNE 98

Buyer: MS 20 JUN 98

Cleanliness Inspection

By: TDS 20 JUNE 98

Buyer: MS 20 JUN 98

-Rings Installed

By: TDS 20 JUNE 98

Buyer: MS 20 JUN 98

Bolt Torque

By: TDS 8-1-98

Comments:

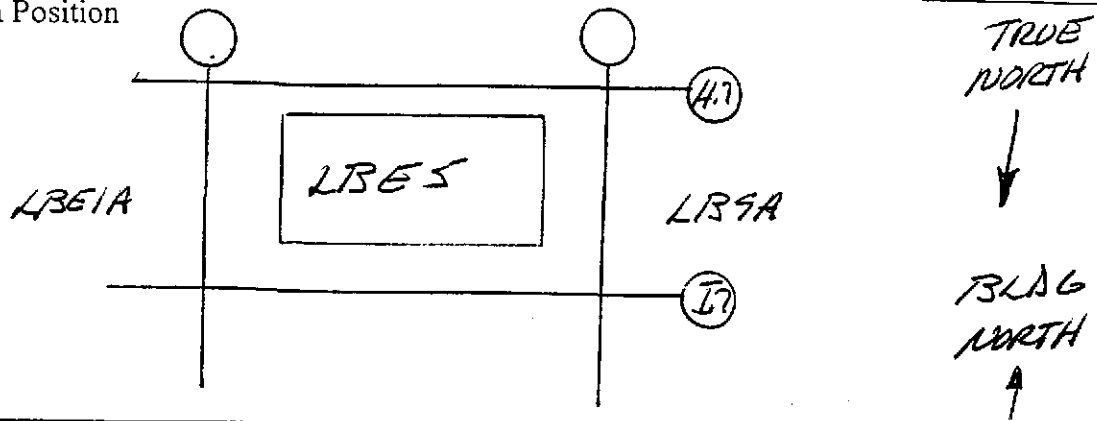
Rework Required:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBES
 Component Name RIGHT BEAM MANIFOLD SPOOL
 Component S/N SP 02
 Component Installation Weight (lb.) 9000 #

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>TGS</i>	15 July 98
2.	Component Located For Anchor Bolt Marking	<i>TGS</i>	15 July 98
	Buyer	<i>MS</i>	15 JUL 98
3.	Final Component Location Complete	<i>TGS</i>	15 July 98
	Buyer	<i>MS</i>	15 JUL 98

SPECIFICATION

Number: A V049-2-174	Rev. 2
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Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 15 JUL 98	
Item Anchored: RBES	No. of Anchors: 4	Size: 1"	Type: HAS STD

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	NLS		15 JUL 98 ↓ 31 AUG 98
Spacing & Location	TBS	NLS		
Anchor Size & Length 1" x 15"	TBS	NLS		
Hole Size 1 1/8"	TBS	NLS		
Hole & Core Condition (no voids, etc.)	TBS	NLS		
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	NLS		
Angle (90 deg. ± 1deg.)	TBS	NLS		
Floor Scarified	TBS	NLS		
Proper Nut Engagement	TBS	NLS		
Tightening	TBS NLS	NLS		

Torque Device Identification: AP-9 250 FT. LBS.

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: NLS	Date: 15 JUL 98
--------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBES

Component Name: RIGHT BEAM MANIFOLD SPOOL

Component S/N: _____

Vacuum Sealing Surfaces Inspection

By: JTS 15 July 98

Buyer: JWS 15 JUL 98

Cleanliness Inspection

By: JTS 15 July 98

Buyer: JWS 15 JUL 98

-Rings Installed

By: JTS 15 July 98

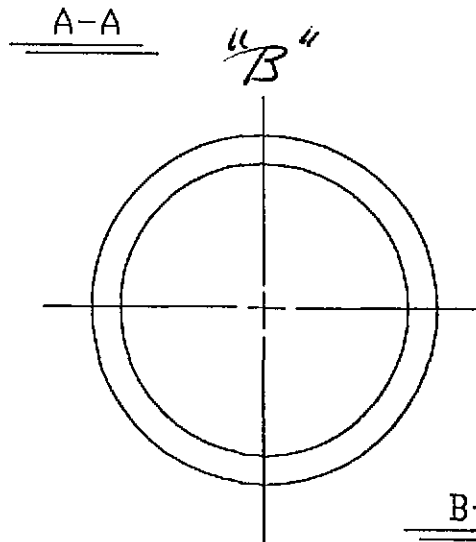
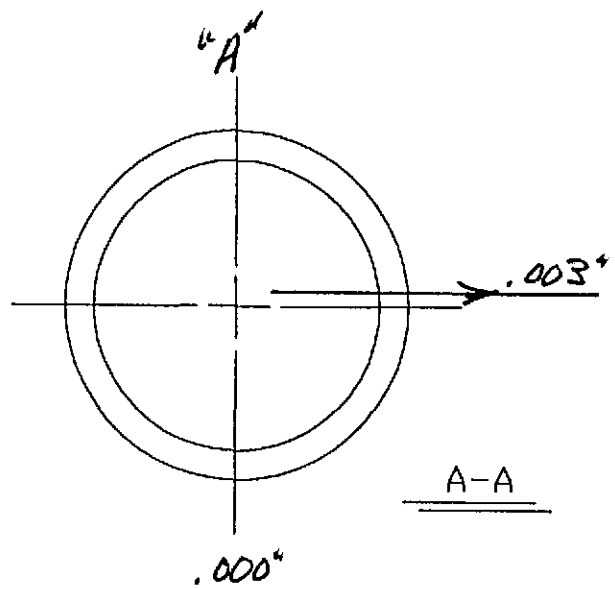
Buyer: JWS 15 JUL 98

Bolt Torque

By: JTS 8-1-98

Comments:

Rework Required:



TILT .153"

LRB1A

.241
BELOW
VERTICAL

LRB5A

.394
BELOW
VERTICAL

BLDG NORTH



A

A

B

Component ID:

LRB5

Serial No.:

5/N 02

	Title: SPOOL PIECE INSTALLED POSITION	Job No. V55049	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

wed

DATE 7/15/98

CORNER ST

PAGE # 20

AM PRE BOLT FOR

LBE-5

ELEV: CALC: .241"

BELOW VERTEX

± .000 EAST FLANGE

ELEV .003 LOW

FINAL LINE & ELEVATION
LBE-5

RESHOT LBE-5 ON 7-17-98
& EAST END DROOPED .025"
FROM INITIAL SET.

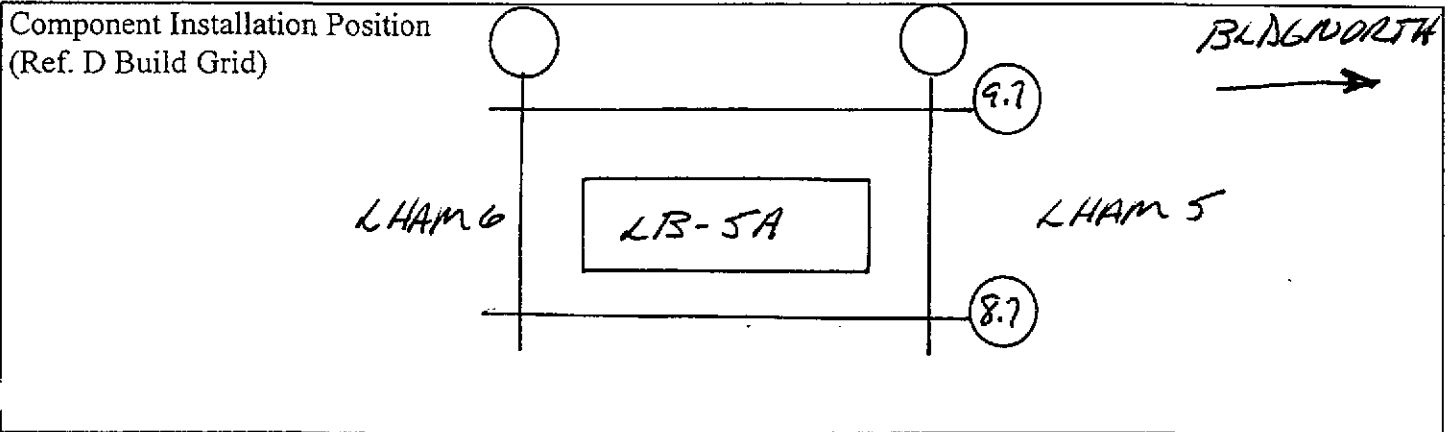
RESCRIBED NORTH
QUARTER MARK TO
MATCH ±. WHEN LBE-1A
IS INSTALLED I WILL
SHOOT QTR. MARK &
ELEVATE WITH LEGS ON
LB-1B.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB-5A
Component Name MODE CLEANER TUBE - LEFT ARM
Component S/N S/W02
Component Installation Weight (lb.) 7000#



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	JTS	23 JUNE 98
	Buyer MRE	JSTW058
3. Final Component Location Complete	JTS	23 JUNE 98
	Buyer JTS	JSTW058

SPECIFICATION	
Number: A V049-2-174	Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LB-5A

Component Name:

MOORE CLEANER TORRE - LEFT ARM

Component S/N:

S/W 02

Vacuum Sealing Surfaces Inspection

By:

JCS 23 JUNE 98

Buyer:

JCS 23 JUNE 98

Cleanliness Inspection

By:

JCS 23 JUNE 98

Buyer:

JCS 23 JUNE 98

O-Rings Installed

By:

JCS 23 JUNE 98

Buyer:

JCS 23 JUNE 98

Bolt Torque

By:

JCS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049
Drawing: V049-5-003	Rev. 3	Date: 23 JUN 98
Item Anchored: MOBE CUR LR-5A	No. of Anchors 20	Size: 1" Type:

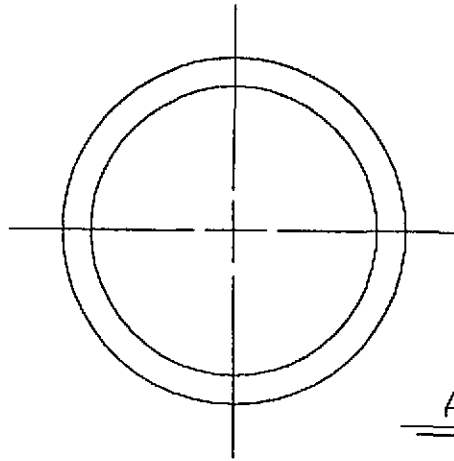
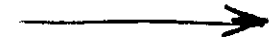
Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	N/A		23 JUN 98
Spacing & Location	TBS	N/A		
Anchor Size & Length 1" x 15"	TBS	N/A		
Hole Size 1 1/8"	TBS	N/A		
Hole & Core Condition (no voids, etc.)	TBS	N/A		
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	N/A		
Angle (90 deg. + 1 deg.)	TBS	N/A		
Floor Scarified	TBS	N/A		
Proper Nut Engagement	TBS	N/A		
Tightening	TBS	N/A		31 AUG 98
Torque Device Identification: AP-9 250 FT LBS STANDARDS 400 FT LBS SUPERS				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

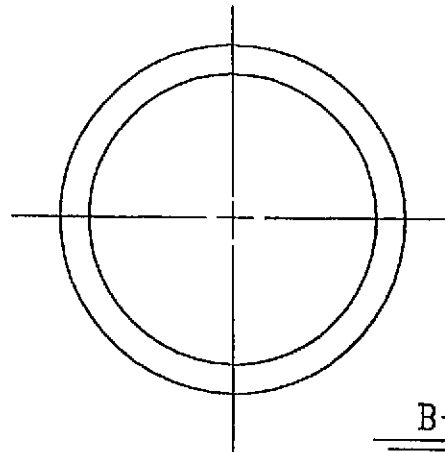
Comments:

Inspection by: <i>[Signature]</i>	Date: 23 JUN 98
-----------------------------------	-----------------

BLDG NORTH

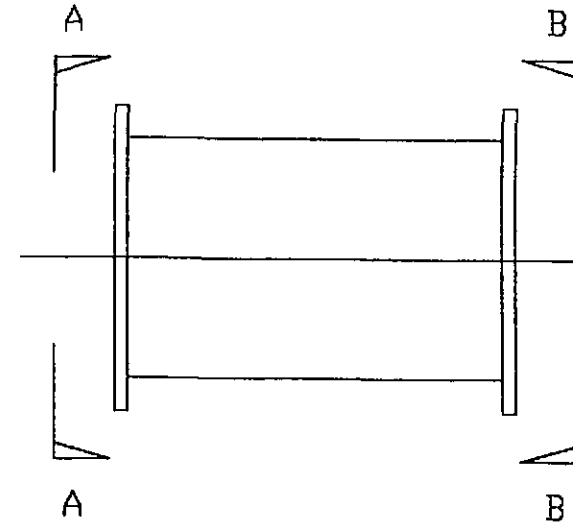


A-A



B-B

LHAM
6



LHAM
5

NO ALIGNMENT
REQUIRED

Component ID:

LIB5A

Serial No.:

S/N 07

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: V59049
	Project: LIGO Equipment Set	Scale: None Dwn By:

TUE

DATE

6/23/78

CORNER ST

PAGE #

71⁰

SET MODE CLEANER
BETWEEN HAM-5#6
LB-5A.

DRILLED & BOLTED
SUPPORT LEGS

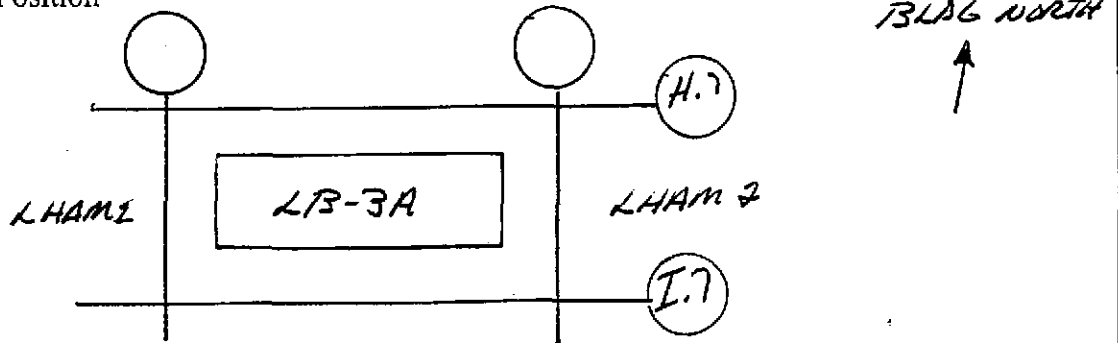
SET SPOOL LBE-3B
BSC-2 - HAM-4

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB-3A
 Component Name MOLE CLEANER TUBE - RIGHT ARM
 Component S/N 5/1002
 Component Installation Weight (lb.) 6800#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	N/A	
2. Component Located For Anchor Bolt Marking	TBS	20 JUNE 98
	Buyer NUS	20 JUN 98
3. Final Component Location Complete	TBS	22 JUNE 98
	Buyer NUS	22 JUN 98

SPECIFICATION

Number: A V049-2-174	Rev. 2
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COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LR-3A

Component Name:

MODE CLEANER TUBE - RIGHT ARM

Component S/N:

S/W 02

Vacuum Sealing Surfaces Inspection

By:

JTS 20 JUNE 98

Buyer:

JMS 30 JUNE 98

Cleanliness Inspection

By:

JTS 20 JUNE 98

Buyer:

JMS 30 JUNE 98

O-Rings Installed

By:

JTS 20 JUNE 98

Buyer:

JMS 30 JUNE 98

Bolt Torque

By:

JTS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 29 JUN 98	
Item Anchored: <i>MONO CLMR LB-3A</i>	No. of Anchors: 20	Size: 1"	Type: HAS + SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TDS	N/A		20 JUN 98 ↓ 21 JUN 98 ↓ 31 AUG 98
Spacing & Location	TDS	N/A		
Anchor Size & Length 1" x 15"	TDS	N/A		
Hole Size 1 1/8"	TDS	N/A		
Hole & Core Condition (no voids, etc.)	TDS	N/A		
Embedment (minus 0 plus 1/8") 8 1/4"	TDS	N/A		
Angle (90 deg. ± 1 deg.)	TDS	N/A		
Floor Scarified	TDS	N/A		
Proper Nut Engagement	TDS	N/A		
Tightening	TGS	N/A		

Torque Device Identification: AP-9 250 FT LBS STANDARD 400# SUPERS

Open Items

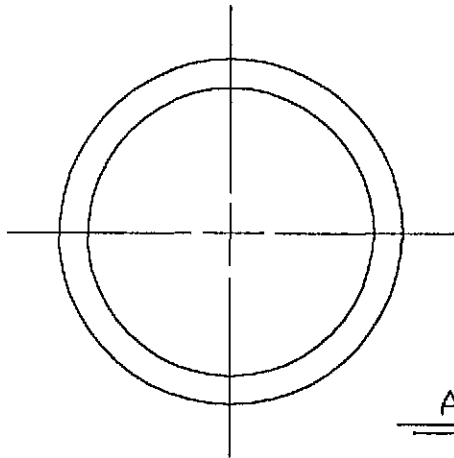
Item No.	Description	Corrective Action	Accept	Date

Comments:

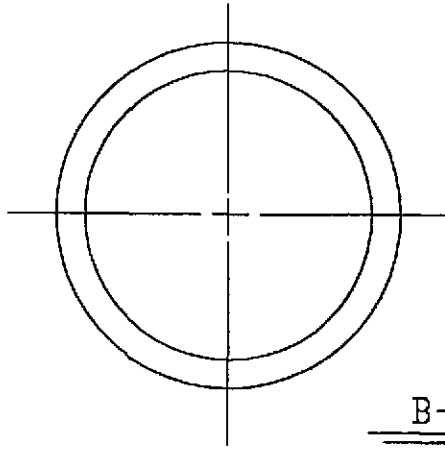
USED SUPER ANCHOR BOLT ON DIAGONAL MEMBER BASE PLATES

Inspection by: *NLS*

Date: 29 JUN 98

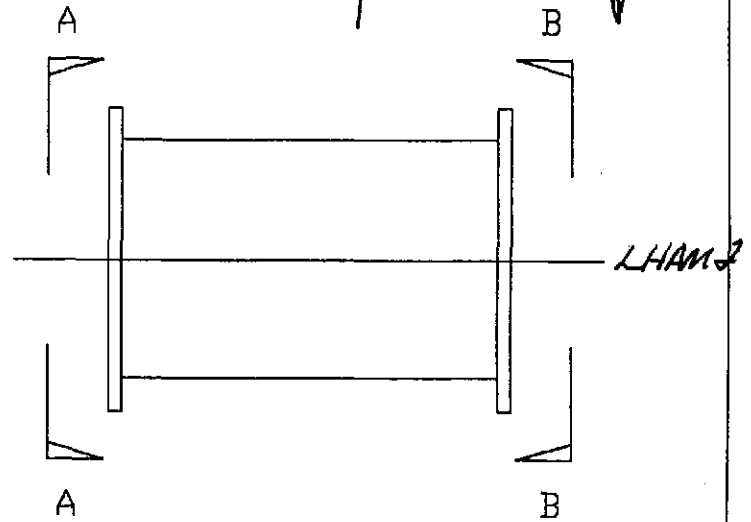


A-A



B-B

LHAM 1



NO ALIGNMENT REQUIRED

Component ID:

LB-3A

Serial No.:

S/N 02

INSTALLED BETWEEN HAM'S 1 & 2
REFER TO CORRESPONDING ALIGNMENT
POINTS

Title: SPOOL PIECE
INSTALLED POSITION

Job No.: V59049

Project: LIGO Equipment Set

Scaler:
None

Dwn By:

20 SAT
21 SUN
22 MON
23 TUE
24 WED
25 THU
26 FRI

DATE 6/20/98 CORNER ST

PAGE # 2019

SET LBE-3A

SET MODE CLEANER
NAM-1 TO 2

NAM-1 OUTER "O" RING NB3A
GROOVE HAD GALLED
ALUMINIUM METAL ON THE
SEAL SIDE OF THE
GROOVE.

I BELIEVE THIS WAS
CAUSED BY ALUMINIUM
GROOVE CLEANERS SIMILAR
TO WHAT P.S.I. SENT US.
IN 5 PLACES BLOBS OF
ALUMINIUM $\approx \frac{1}{16}$ " IN SIZE
WAS ADHERED TO GROOVE.

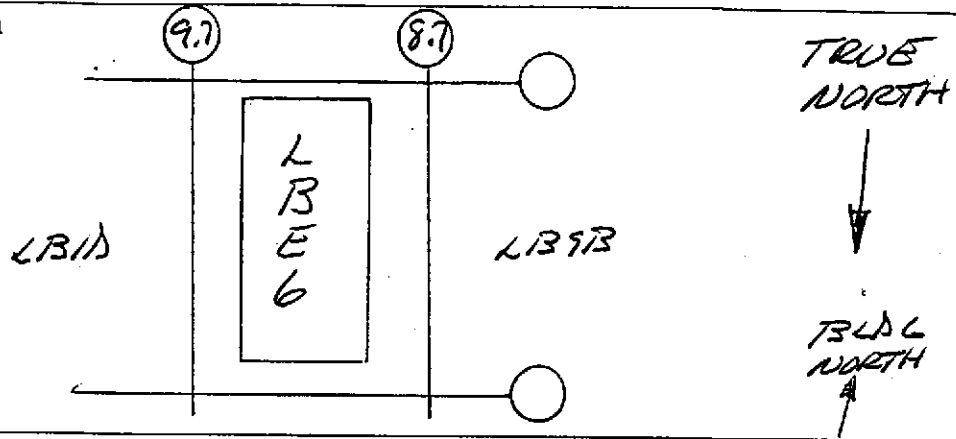
ALSO THERE WAS ALUM.
SMEARED IN A THIN LAYER.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LB E 6
 Component Name LEFT BEAM MANIFOLD SPOUL
 Component S/N S/NO 2
 Component Installation Weight (lb.) 9000#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>JTS</i>	13 July 98
2.	Component Located For Anchor Bolt Marking	<i>JTS</i>	13 July 98
	Buyer	<i>M.S.</i>	13 JUL 98
3.	Final Component Location Complete	<i>JTS</i>	14 July 98
	Buyer	<i>M.S.</i>	14 JUL 98

SPECIFICATION

Number: A V049-2-174	Rev. 2
-------------------------	-----------

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 13 JUL 98	
Item Anchored: LBEG	No. of Anchors 4	Size: 1"	Type: HAS-STD

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	NLS		13 JUL 98
Spacing & Location	TBS	NLS		
Anchor Size & Length 1" x 15"	TBS	NLS		
Hole Size 1 1/8"	TBS	NLS		
Hole & Core Condition (no voids, etc.)	TBS	NLS		
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	NLS		
Angle (90 deg. ± 1 deg.)	TBS	NLS		
Floor Scarified	TBS	NLS		
Proper Nut Engagement	TBS	NLS		
Tightening	TBS	NLS		28 AUG 98

Torque Device Identification: AP-9 250 FT. LBS.

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by:	Date: 13 JUL 98
----------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LBE 6

Component Name: RIGHT BEAM MANIFOLD SPOOL

Component S/N: S/N 02

Vacuum Sealing Surfaces Inspection

By: TBS 14 July 98

Buyer: JSE 14 JUL 98

Cleanliness Inspection

By: TBS 14 July 98

Buyer: JSE 14 JUL 98

-Rings Installed

By: TBS 14 July 98

Buyer: JSE 14 JUL 98

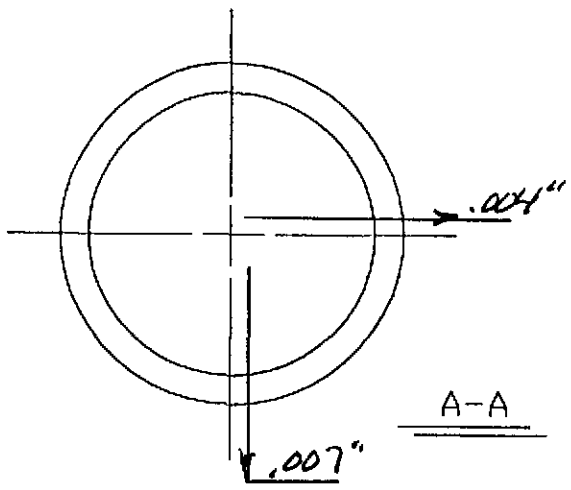
Bolt Torque

By: TBS 8-1-98

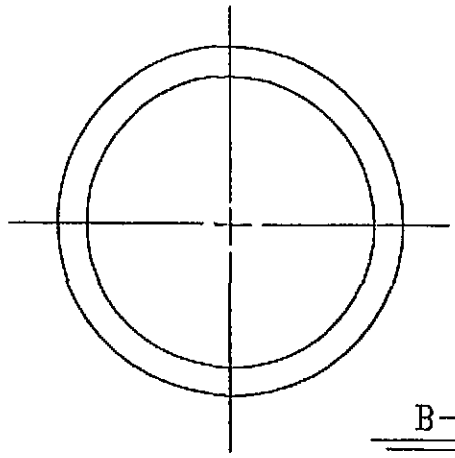
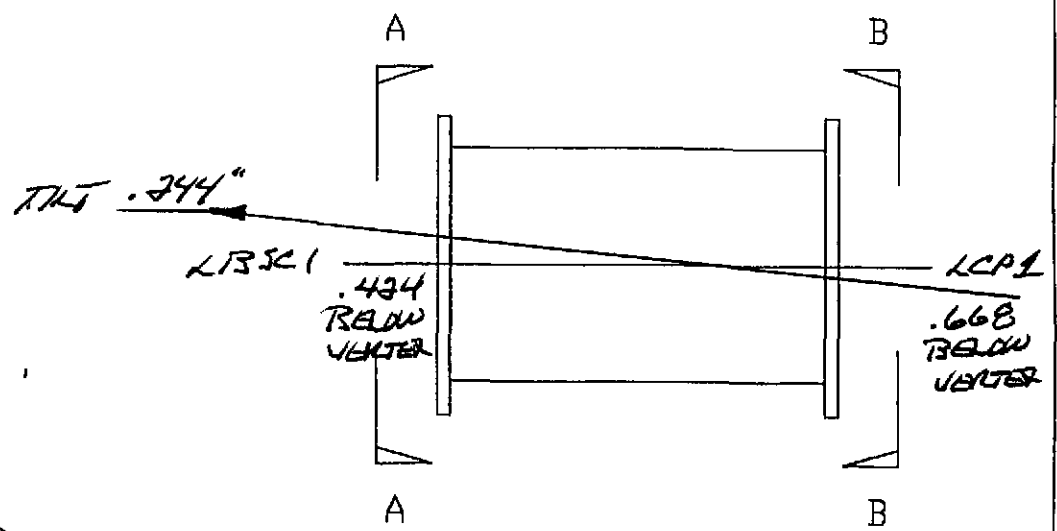
Comments:

Rework Required:

BLDG NORTH →



A-A



B-B

Component ID: LBSCL

Serial No.: 07

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

Monday

DATE 7/13

CORNER ST

PAGE 2

PRE BOLT
LB-9A

EAST FLANGE
.018 NORTH of ϕ

DUAL BOBS

$3'4\frac{1}{4}" \pm .010$

ENDO $\frac{1}{8}$ SHORT

MOVED LB-9A &
DRILLED & PLACED
ANCHOR BOLTS. SCARIFIED
FLOOR.

LB E-6

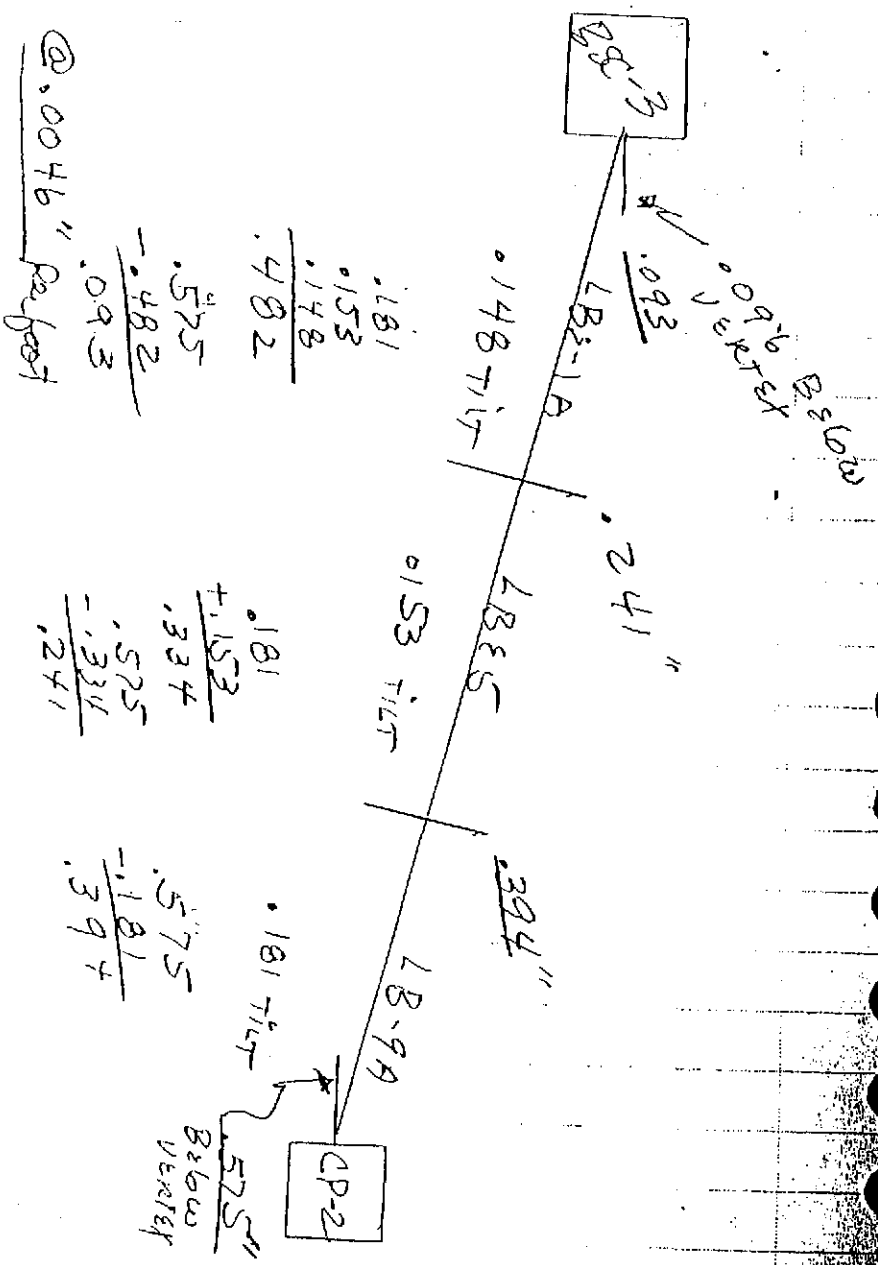
DRILLED BOLTS
& SCARIFIED FLOOR
RE SET LB E-6

LB-9A FINAL

EAST FLANGE ϕ
 .005 NORTH OF ϕ
 ELEV: .003" LOW
 .394 BEL
 VERTEX

LB-E-6 FINAL
 NORTH FLANGE ϕ
 .007 WEST OF ϕ

ELEV: CALC: .420
 .004 LOW Below VERTEX
~~.00746~~ " PER FOOT
 .00746" PER FOOT



SAT
DATE 7/11/98 CORNER ST

PAGE # 76⁰

LBE-6

NORTH FLANGE

56.2395 FROM VERTEX

.420" BELOW VERTEX

PRE BOLT 7-13-98

NORTH ϕ

.007 EAST OF ϕ

ELEV.

NORTH FLANGE

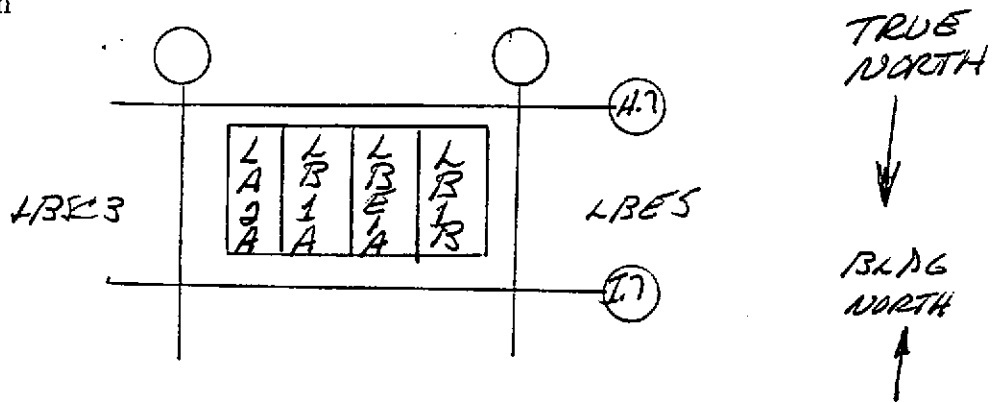
.015" High

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
 COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA2A/LB1A/LBE1A/LB1B
 Component Name RIGHT BEAM MANIFOLD SPOOLS
 Component S/N 01/03/01/04/
 Component Installation Weight (lb.) 9500#

Component Installation Position
 (Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	TSS	18 July 98
2. Component Located For Anchor Bolt Marking	TSS	18 July 98
	Buyer MSE	18 JUL 98
3. Final Component Location Complete	TSS	22 July 98
	Buyer MSE	22 JUL 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5003	Rev. 3	Date: 31 JUL 98	
Item Anchored: LA2A/LB1A/LB2A/LB1B	No. of Anchors 32	Size: 1"	Type: HAS-5T8

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	N/A		↓ 30 JUL 98
Spacing & Location 1" x 15"	TBS	N/A		
Anchor Size & Length 1" x 19 1/8"	TBS	N/A		
Hole Size 1 1/8"	TBS	N/A		
Hole & Core Condition (no voids, etc.)	TBS	N/A		
Embedment (minus 0 plus 1/8") 13 3/8"	TBS	N/A		
Angle (90 deg. ± 1 deg.) 8 1/4"	TBS	N/A		
Floor Scarified	TBS	N/A		
Proper Nut Engagement	TBS	N/A		
Tightening	TBS	N/A		

Torque Device Identification: HP-9 350 FT/LBS

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:
 ABOVE LISTED SPOOLS INSTALLED AS ONE UNIT

Inspection by: NICE	Date: 31 JUL 98
---------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LA2A / LB1A / LBE1A / LB1B

Component Name:

RIGHT BEAM MANIFOLD SPOOLS

Component S/N:

01 / 03 / 01 / 04

Vacuum Sealing Surfaces Inspection

By:

TDS 22 July 98

Buyer:

MS 22 JUL 98

Cleanliness Inspection

By:

TDS 22 July 98

Buyer:

MS 22 JUL 98

-Rings Installed

By:

TDS 22 July 98

Buyer:

MS 22 JUL 98

Bolt Torque

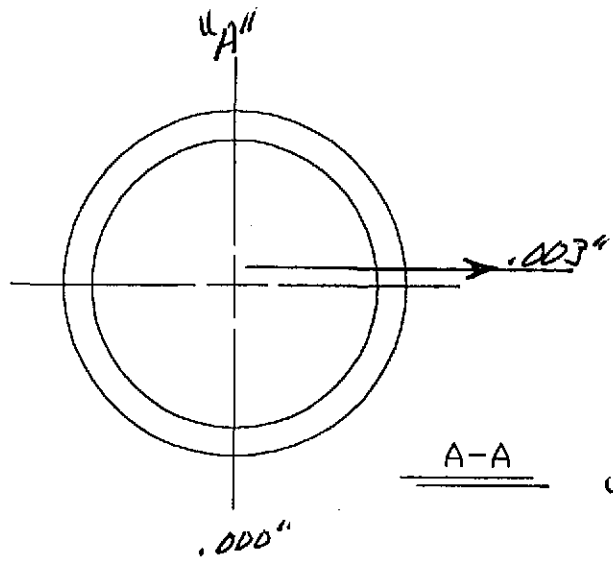
By:

TDS 8-1-98

Comments:

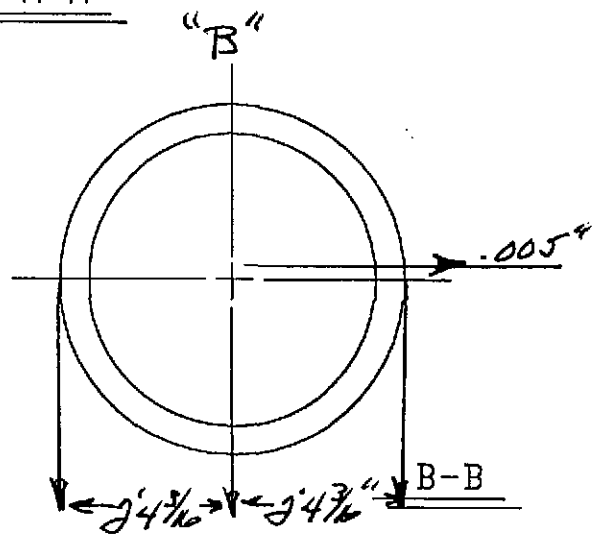
Rework Required:

BLDG NORTH ↑

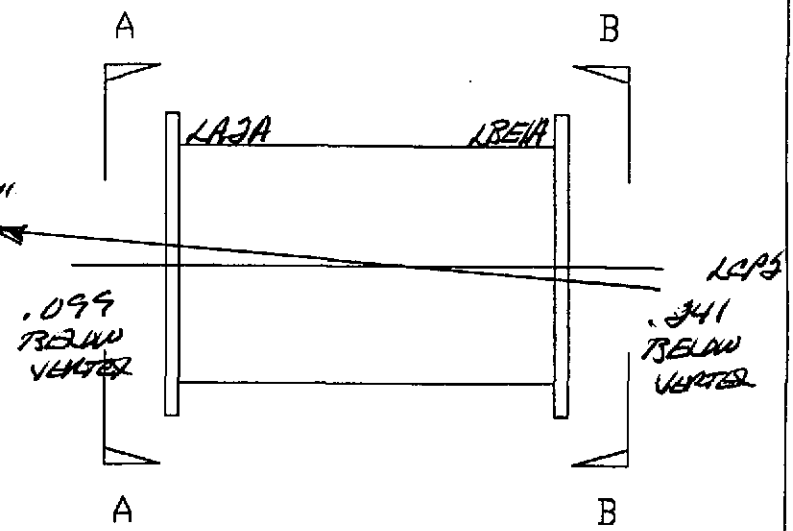


A-A

.000"



TILT .147"



Component ID: LAJA/LBIA/LBEIA/LBIB
 Serial No: 01/03/01/04/

	Title: SPOOL PIECE INSTALLED POSITION	Job No: <u>155049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

wed

DATE

7/22/98 CORNER ST

PAGE #

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LBE-1A

FINAL SET

EAST END ϕ

DUAL BOBS $2'4\frac{3}{16} \pm .010$

ELEV: EAST END.

CALC .096" BELOW VERTE

SHOT .003 LOW (.099 BEL

SHOT WEST END ϕ

.005" LOW

.246" BELOW VERTEX

CALC: .241" BELOW

DAVE EVERS Q.C.

Pat
DATE 7/18/08 Corner St. PAC

LBE-1A

EAST FLANGE ELEVATION

CALC^o .096 BELOW VERTEX ZE

ZE

23

DUAL BOBS ON ALL
THREE JOINTS

2'43/16" @ AT EAST
OTHER JOINTS ± .030"

CONTINUE WORK ON
GROUT FORMS.

STARTED DRILLING ON
LBE-1A.

INSTALLED 6" GATE
VALVE ON LBE-6

TUE

DATE

7/21/88 CORNER ST

PAGE #

76

A/C OFF AGAIN THIS MORNING

CONTINUED WORKING ON
GROUT FORMS.

MIXER ARRIVED PM.
SET UP & ARE READY

CONTINUED DRILLING
ON LBE-1A

1 BAD HOLE TOOK 2 3/4"
BIT BROKE OFF IN REBAR

CONTINUE WORK ON
GROUT FORMS.

STARTED DRILLING ON
LBE-1A.

INSTALLED 6" GATE
VALVE ON LBE-6

TUE

DATE

7/21/88 CORNER ST

PAGE #

7/6

A/C OFF AGAIN THIS MORNING

CONTINUED WORKING ON
GROUT FORMS.

MIXER ARRIVED PM.
SET UP & ARE READY

CONTINUED DRILLING
ON LBE-1A

1 BAD HOLE TOOK 2 3/4
BIT BROKE OFF IN REBAR

wed

DATE

7/22/98 CORNER ST

PAGE

70

LBE-1A

FINAL SET

EAST END ♀

DUAL BOBS $2'4\frac{3}{16} \pm .01$

ELEV: EAST END.

CALC .096" BELOW VERI

SHOT .003 LOW (.099 BEL)

SHOT WEST END ♀

.005" LOW

.246" BELOW VERTEX

CALC: .241" BELOW

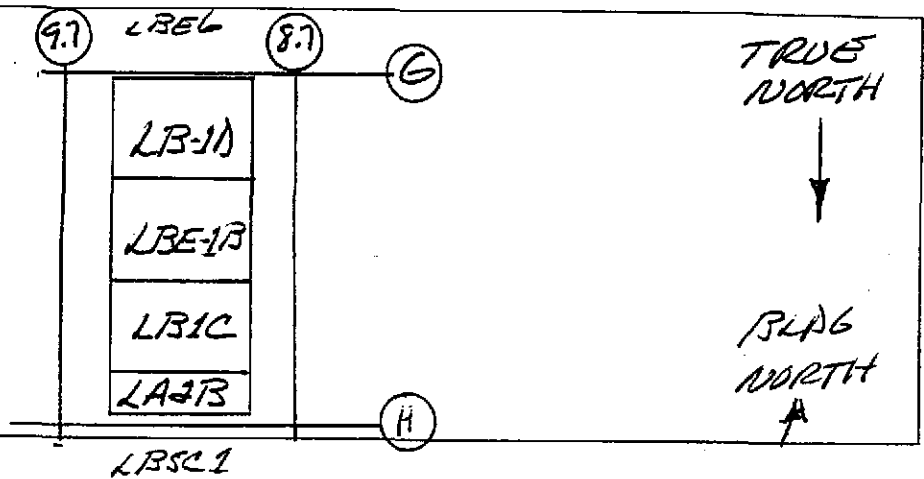
DAVE EVERS Q.C.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LA2B/LB1C/LBE1B/LB1A
 Component Name SPOOLS - LEFT BEAM MANIFOLD
 Component S/N S/N 03 / S/N 05 / S/N 02 / S/N 06
 Component Installation Weight (lb.) 9500#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>JTS</i>	16 July 98
2.	Component Located For Anchor Bolt Marking	<i>JTS</i>	16 July 98
	Buyer	<i>JSE</i>	16 JUL 98
3.	Final Component Location Complete	<i>JTS</i>	20 July 98
	Buyer	<i>JSE</i>	30 JUL 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev: 3	Date: 16 JUL 98	
Item Anchored: LA3B/LB1C/LRE1R/LR1A	No. of Anchors: 32	Size: 1"	Type: HAS-STA
Attribute	a. Installer	b. Accepted	c. N/A
Anchor Type (HAS Std or Super)	TBS	NUE	
Spacing & Location	TBS	NUE	
Anchor Size & Length 1" x 15"	TBS	NUE	
Hole Size 1 1/8"	TBS	NUE	
Hole & Core Condition (no voids, etc.)	TBS	NUE	
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	NUE	
Angle (90-deg. ± 1deg.)	TBS	NUE	
Floor Scarified	TBS	NUE	30 JUL 98
Proper Nut Engagement	TBS	NUE	
Tightening	TBS	NUE	28 AUG 98
Torque Device Identification: AH-9 750 FT LBS			

Open Items

Item No.	Description	Corrective Action	Accept	Date

Comments:

ABOVE LISTED SPOOLS ASSEMBLED AS ONE UNIT.

Inspection by: <u>NUE</u>	Date: 16 JUL 98
---------------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LA3B/LB1C/LBE1B/LB1A

Component Name:

SPOOLS - LEFT BEAM MANIFOLD

Component S/N:

02/05/02/06

Vacuum Sealing Surfaces Inspection

By:

JTS 20 July 98

Buyer:

JWE 30 JUL 98

Cleanliness Inspection

By:

JTS 20 July 98

Buyer:

JWE 30 JUL 98

O-Rings Installed

By:

JTS 20 July 98

Buyer:

JWE 30 JUL 98

Bolt Torque

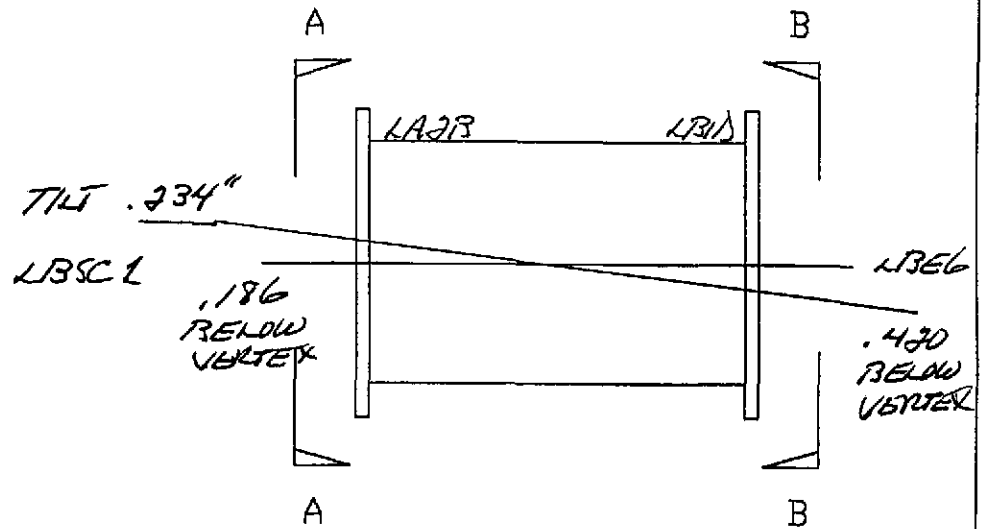
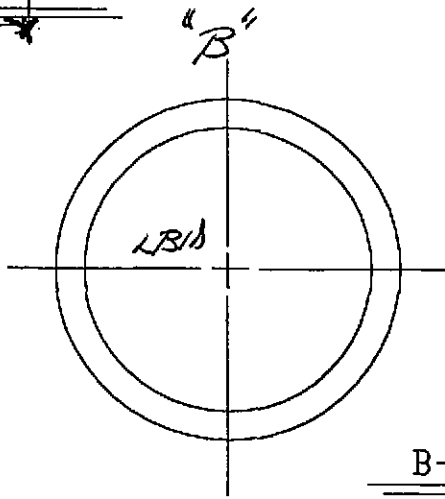
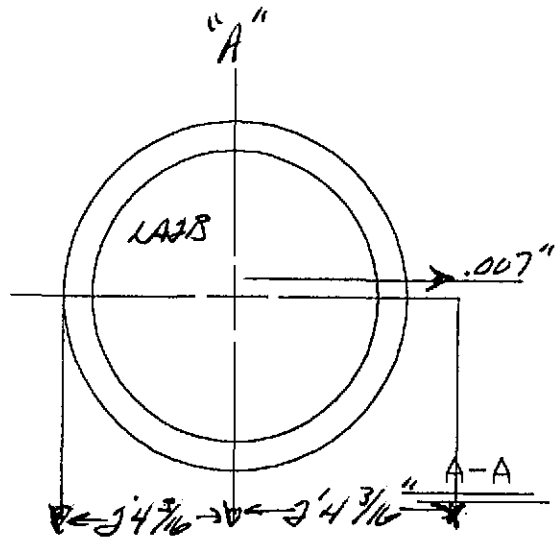
By:

JTS 8-1-98

Comments:

Rework Required:

BLDG NORTH
 →



B-B

Component ID: LA2B/LB1C/LB2B/LB1A
 Serial No.: 02/05/02/06

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: V55049
	Project: LIGO Equipment Set	Scale: None Dwn By:

MON

DATE

7/20/88 CORNER

PAGE #

8

FINISHED PRELIMINARY
SET LBE-1A

DAVE EVERS Q.C. OK.
Clocking, $\pm .010$ " shot.
STARTED DRILLING
AFTER LUNCH.

FINAL SET
LBE-1B

NORTH END

DUAL BOBS

$2'4\frac{3}{16} \pm .010$

ELEVATION:

CALC: .179" Below VE.

.007 low.

.186" Below VERTEX

clocking OK

Thur

DATE

7/16/98

CORNER ST

PAGE # 68

LBE-1B

PRE BOLT

ELEV: CALC: 0.179" Below
SHOT: 0.000 VERTEX

&

DUAL BOBS ON 3 JOINTS
BSC END & EACH SIDE
OF BELLOW.

BOBS SHOWED A KINK
THROUGH BELLOW OF
1/4" AT END OF SPOOL.

ADJUSTED BELLOW BOLTS
& ATTAINED $3/4 \pm 0.015$
ON ALL THREE JOINTS.

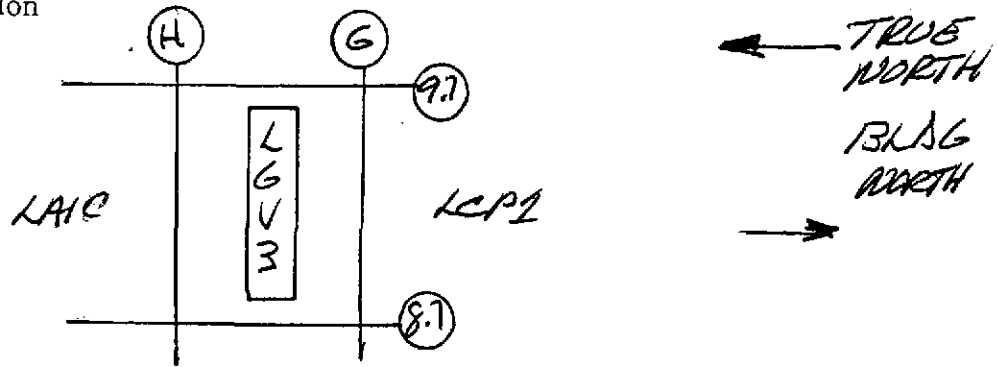
STARTED DRILLING FOR
ANCHOR BOLTS

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LGV-3
 Component Name LEFT BEAM MANIFOLD 44" GATE VALVES
 Component S/N S/N 031
 Component Installation Weight (lb.) 7300#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	TDS	2 July 98
2. Component Located For Anchor Bolt Marking	TDS	2 July 98
	Buyer MSE	3 JUL 98
3. Final Component Location Complete	TDS	9 July 98
	Buyer MSE	9 JUL 98

SPECIFICATION

Number: A V049-2-174
 Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LGV3

Component Name: BEAM TUBE GATE VALVE (LEFT ARM)

Component S/N: S/N 031

Vacuum Sealing Surfaces Inspection

By: JTS 9 JULY 98

Buyer: JMS 9 JUL 98

Cleanliness Inspection

By: JTS 9 JULY 98

Buyer: JMS 9 JUL 98

-Rings Installed

By: JTS 9 JULY 98

Buyer: JMS 9 JUL 98

Bolt Torque

By: JTS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 2 JUL 98	
Item Anchored: LGV 3	No. of Anchors 4	Size: 3/4"	Type: HAS-STA

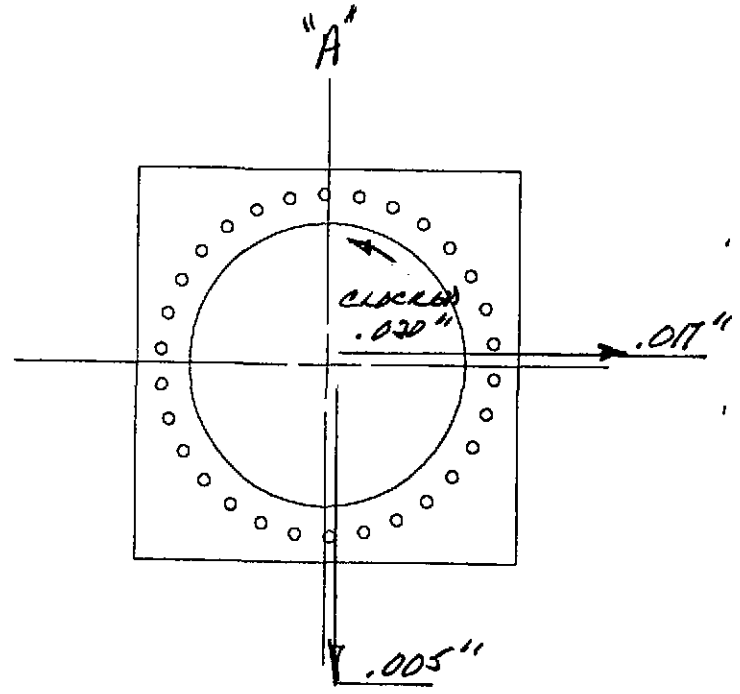
Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TAS	NLS		2 JUL 98 ↓ 31 AUG 98
Spacing & Location	TAS	NLS		
Anchor Size & Length 3/4" x 13 3/8"	TAS	NLS		
Hole Size	TAS	NLS		
Hole & Core Condition (no voids, etc.)	TAS	NLS		
Embedment (minus 0 plus 1/8") 6 5/8"	TAS	NLS		
Angle (90 deg. ± 1 deg.)	TAS	NLS		
Floor Scarified	TAS	NLS		
Proper Nut Engagement	TAS	NLS		
Tightening	TAS	NLS		
Torque Device Identification: AD-9 250 FT. LB				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

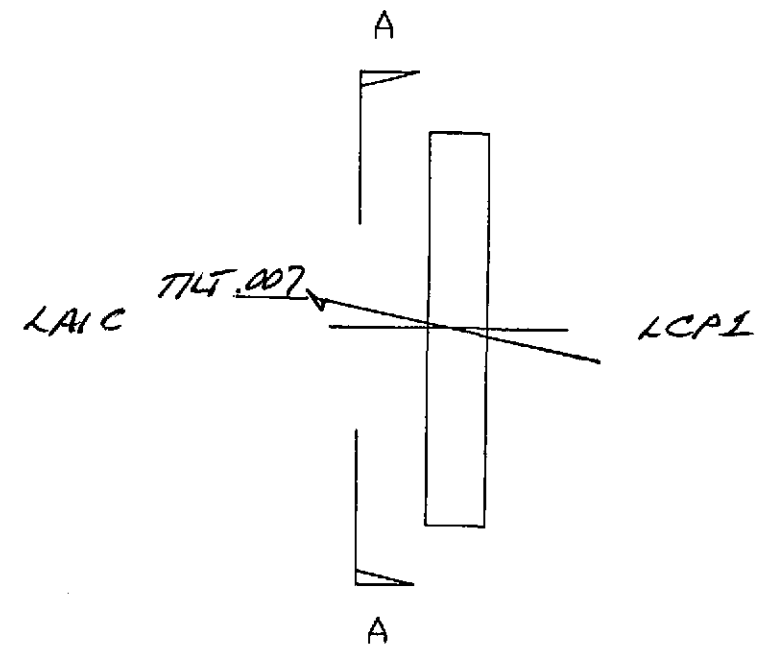
Comments:

Inspection by: <i>NLS</i>	Date: 2 JUL 98
---------------------------	----------------

BANK NORTH
 →



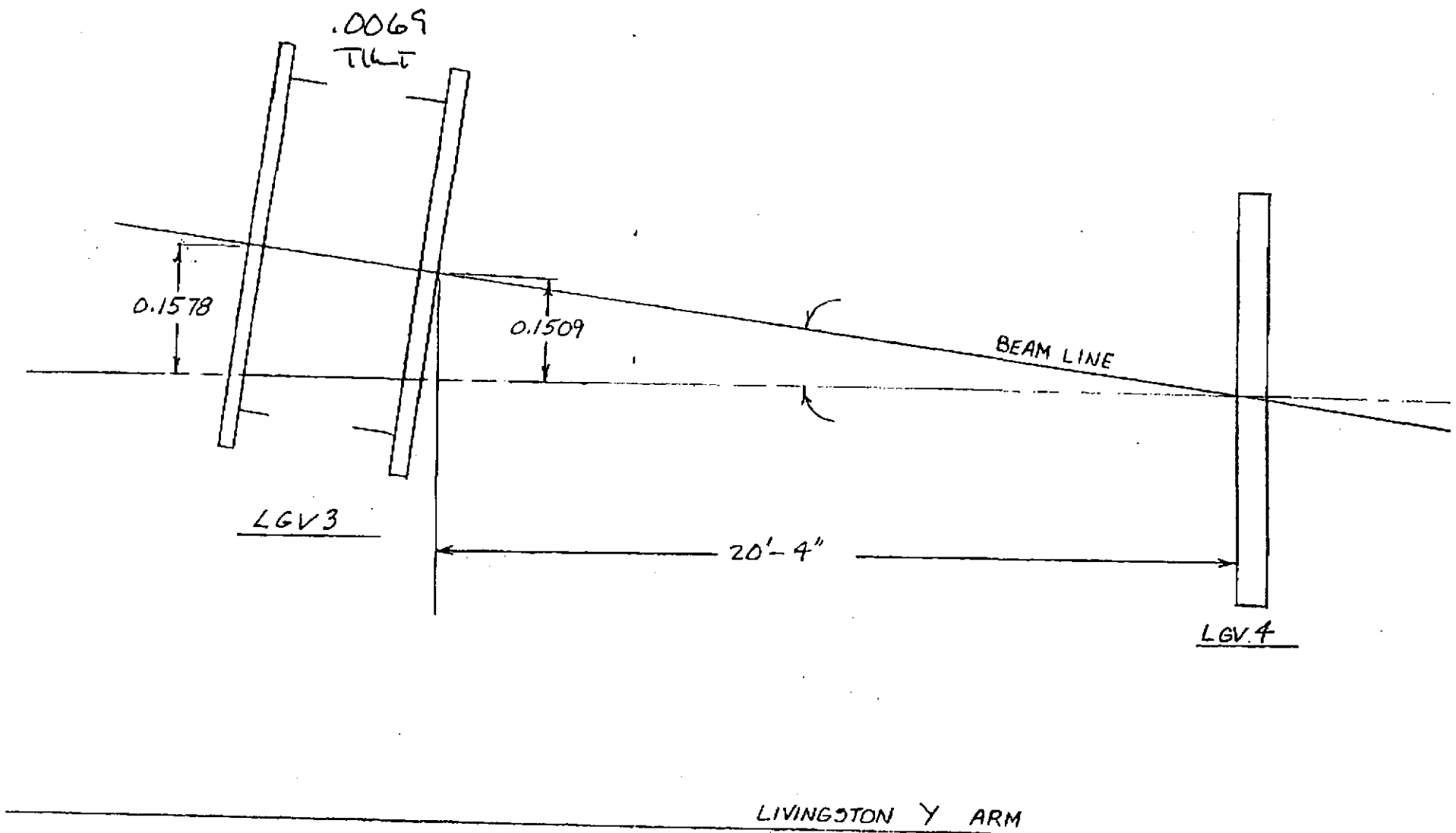
A-A



Component ID: LGVB

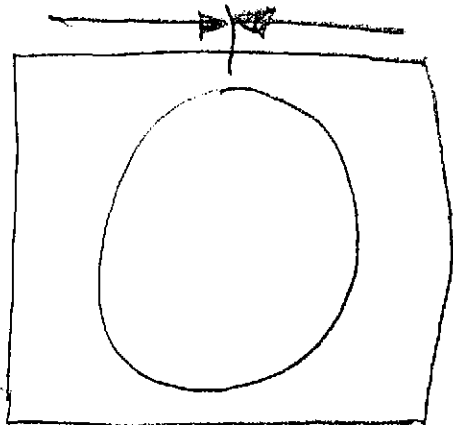
Serial No.: S/N 031

	Title: GATE VALVE INSTALLED POSITION	Job No.: <u>V55049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:



29.565"

29.448"



29.509"

29.504"

29.565

29.509

29.448

29.504

59.013"

59.005

59.013

.565

.448

.117

$$\begin{array}{r} 58.5 \\ 2 \overline{) 117} \\ \underline{10} \\ 17 \\ \underline{16} \\ 10 \end{array}$$

DATE

PAGE #

Thu

DATE

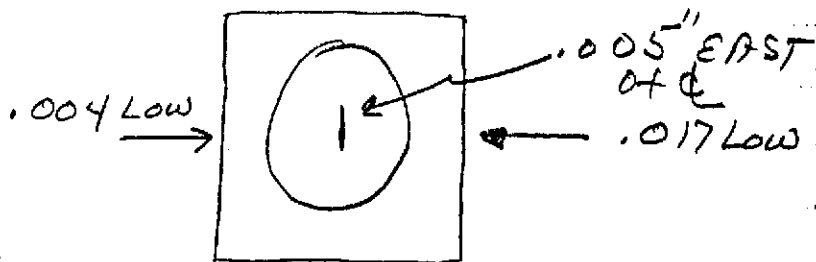
7/9/90

CORNER ST.

PAGE

76^o

FINAL SET ON GV-3



VALVE ϕ .011" Low

CALC .974" BELOW VERTEX

MEAS. .985 " "

ϕ .005 EAST OF ϕ
Clocking!

TOP. .017" EAST OF ϕ

BOTTOM. .003" WEST OF ϕ

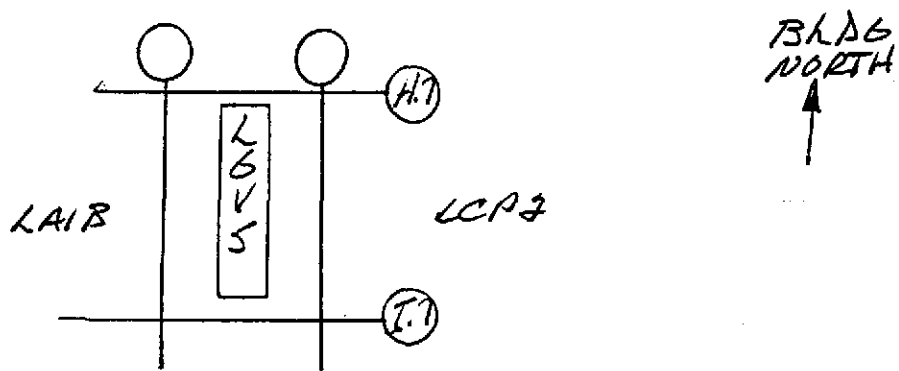
CLOCKED. .020" C.C.W.

Title: **LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE**

**ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET**

Component Tag Number L6V5
 Component Name RIGHT BEAM MANIFOLD 44" GATE VALVE
 Component S/N S/N 032
 Component Installation Weight (lb.) 7300#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified		
2.	Component Located For Anchor Bolt Marking	<i>JTB</i>	29 JUNE 98
		Buyer <i>WSE</i>	29 JUN 98
3.	Final Component Location Complete	<i>JTB</i>	10 JULY 98
		Buyer <i>WSE</i>	10 JUN 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049
Drawing: V045-5-003	Rev. 3	Date: 29 JUN 98
Item Anchored: L6V5 SUPPORT	No. of Anchors 2	Size: 3/4" Type: HAS-STA

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TAS	NIS		29 JUN 98
Spacing & Location	TAS	NIS		↓ 10 JUL 98 ↓ 31 AUG 98
Anchor Size & Length 3/4" x 13 3/8"	TAS	NIS		
Hole Size 7/8"	TAS	NIS		
Hole & Core Condition (no voids, etc.)	TAS	NIS		
Embedment (minus 0 plus 1/8") 6 3/8"	TAS	NIS		
Angle (90 deg. ± 1 deg.)	TAS	NIS		
Floor Scarified	TAS	NIS		
Proper Nut Engagement	TAS	NIS		
Tightening	TCSMS	NIS		

Torque Device Identification: AP-9 250 FT/LBS.

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <u>NIS</u>	Date: <u>29 JUN 98</u>
---------------------------	------------------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LGV5

Component Name:

RIGHT BEAM MANIFOLD 44" GATE VALVES

Component S/N:

5/W 033

Vacuum Sealing Surfaces Inspection

By:

TGS 10 July 98

Buyer:

NUS 10 JUL 98

Cleanliness Inspection

By:

TGS 10 July 98

Buyer:

NUS 10 JUL 98

O-Rings Installed

By:

TGS 10 July 98

Buyer:

NUS 10 JUL 98

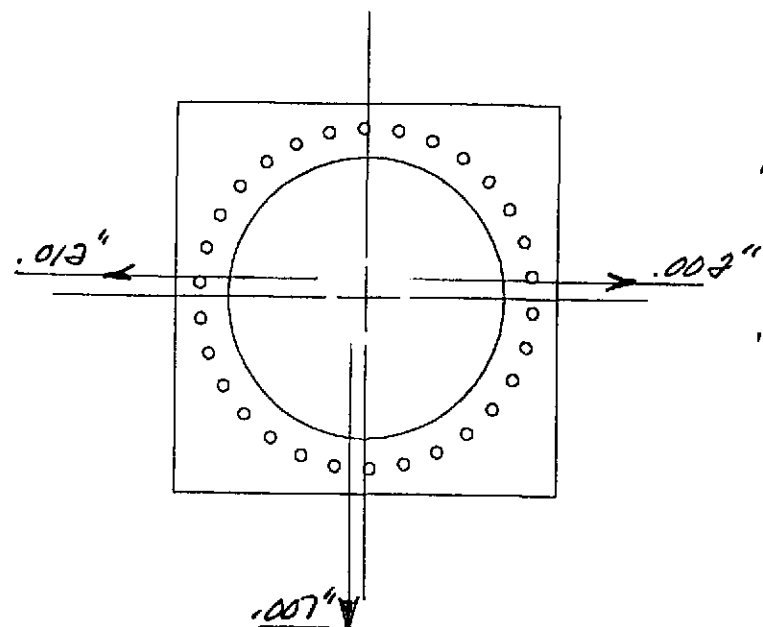
Bolt Torque

By:

TGS 8-7-98

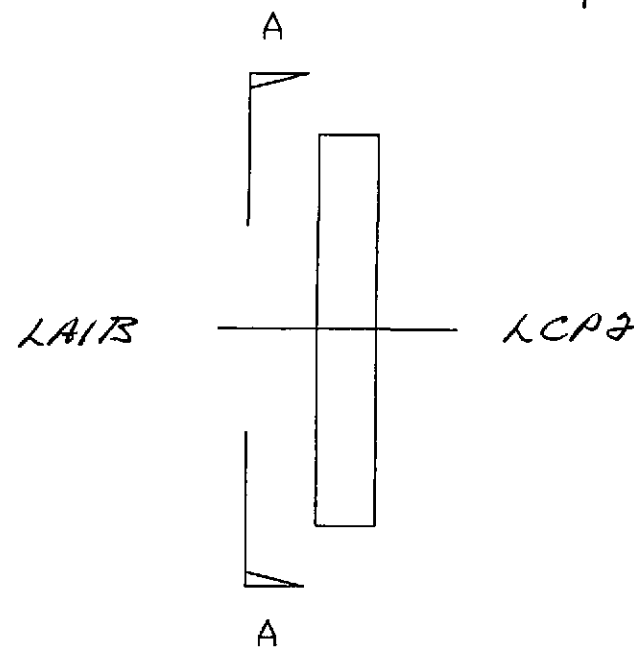
Comments:

Rework Required:



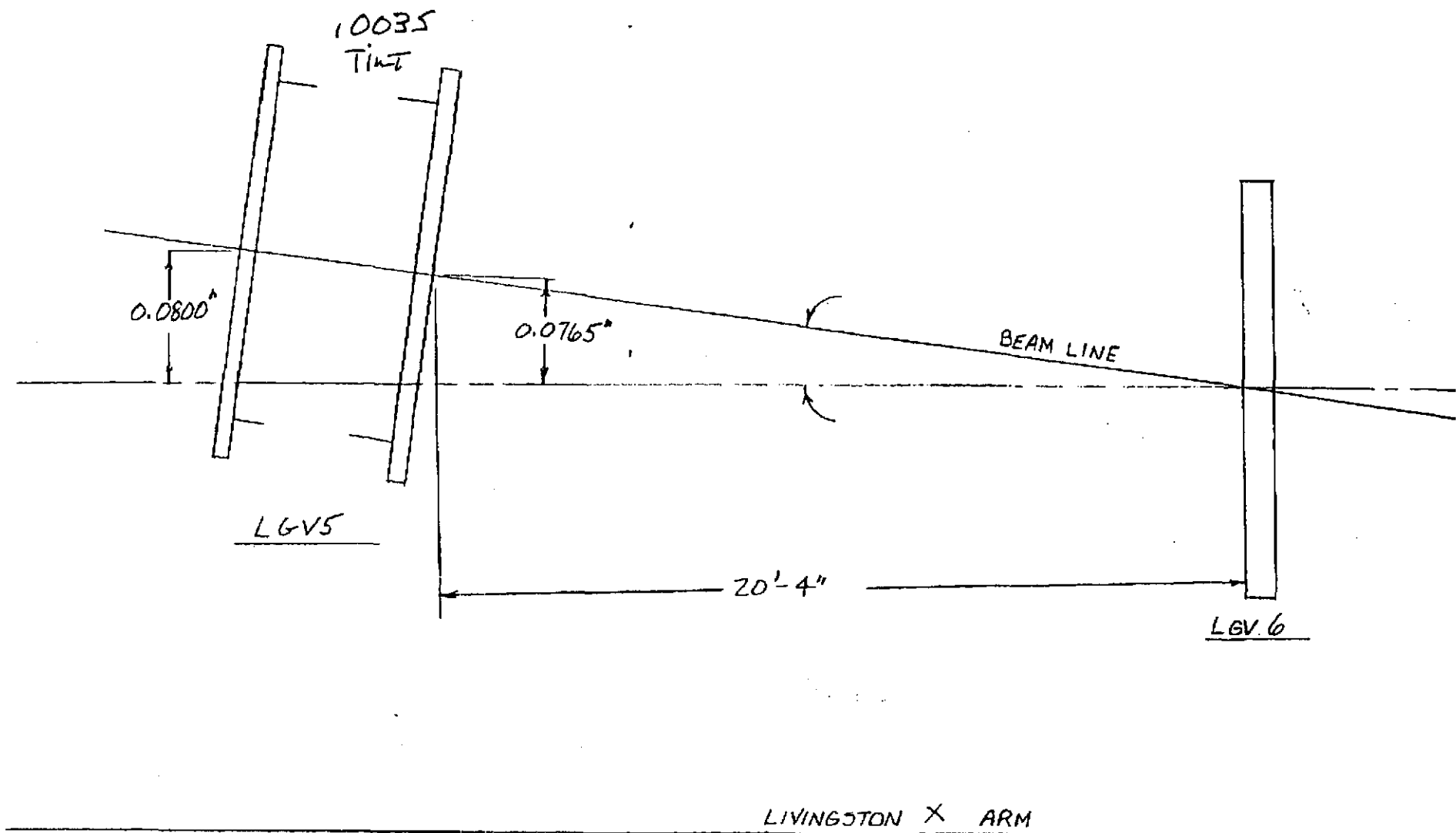
A-A

BLDG
NORTH
↑

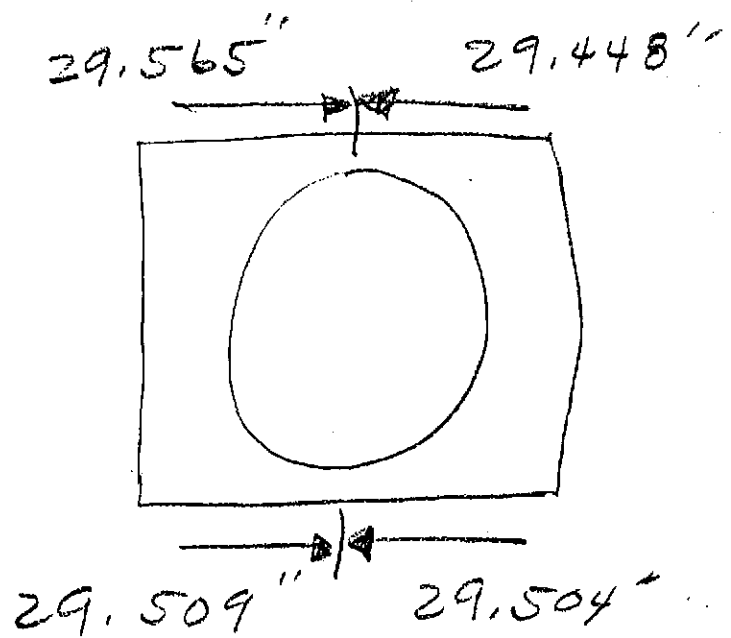


Component ID: LGV-5
 Serial No.: 5/10032

	Title: GATE VALVE INSTALLED POSITION	Job No.: <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:



DATE 7/10/88 CORNER ST



$$\begin{array}{r} 29.565 \\ 29.448 \\ \hline 59.013 \end{array}$$

$$\begin{array}{r} 29.509 \\ 29.504 \\ \hline 59.013 \end{array}$$

$$\begin{array}{r} .565 \\ .448 \\ \hline .117 \end{array}$$

$$\begin{array}{r} 58.5 \\ 2 \overline{) 117} \\ \underline{10} \\ 17 \\ \underline{16} \\ 10 \end{array}$$

LGV-5 VALVE

.007" NORTH OF ϕ

NORTH SIDE OF VALVE
AS SHOT FROM DRILL
HOLES.

1002" LOW

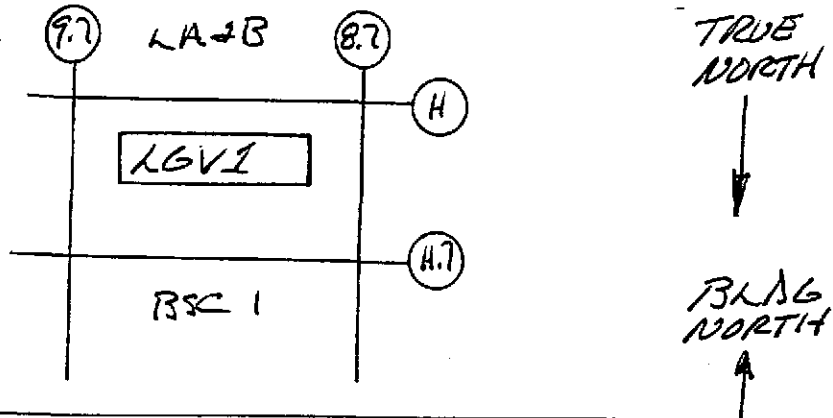
SOUTH SIDE
.012 LOW.

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LGVI
 Component Name LEFT BEAM MANIFOLD 48" GATE VALVE
 Component S/N 5/1027
 Component Installation Weight (lb.) 7500#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified		
2.	Component Located For Anchor Bolt Marking		
	Buyer		
3.	Final Component Location Complete	<i>T/28</i>	27 July 98
	Buyer	<i>JMS</i>	27 JUL 98

SPECIFICATION

Number:	Rev.
A V049-2-174	2

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date:	
Item Anchored: LGV1 STAND	No. of Anchors 4	Size: 3/4"	Type: HAS-STD

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TBS	NUS		27 JUL 98
Spacing & Location	TBS	NUS		
Anchor Size & Length 3/4" x 13 3/8"	TBS	NUS		
Hole Size 7/8"	TBS	NUS		
Hole & Core Condition (no voids, etc.)	TBS	NUS		
Embedment (minus 0 plus 1/8") 6 5/8"	TBS	NUS		
Angle (90 deg. ± 1deg.)	TBS	NUS		
Floor Scarified	TBS	NUS		
Proper Nut Engagement	TBS	NUS		27 JUL 98
Tightening	TBS	NUS		28 AUG 98

Torque Device Identification: AP-9 250 FT. LBS

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: NUS	Date: 27 JUL 98
--------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LGVI

Component Name: LEFT BEAM MANIFOLD 48" GATE VALVE

Component S/N: _____

Vacuum Sealing Surfaces Inspection

By: ITG 27 JULY 98

Buyer: WSE 27 JUL 98

Cleanliness Inspection

By: ITG 27 July 98

Buyer: WSE 27 JUL 98

Rings Installed

By: ITG 27 July 98

Buyer: WSE 27 JUL 98

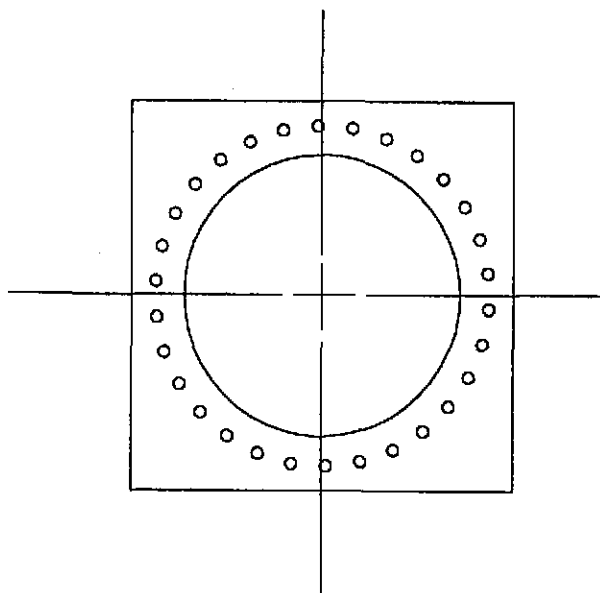
Bolt Torque

By: ITG 8-1-98

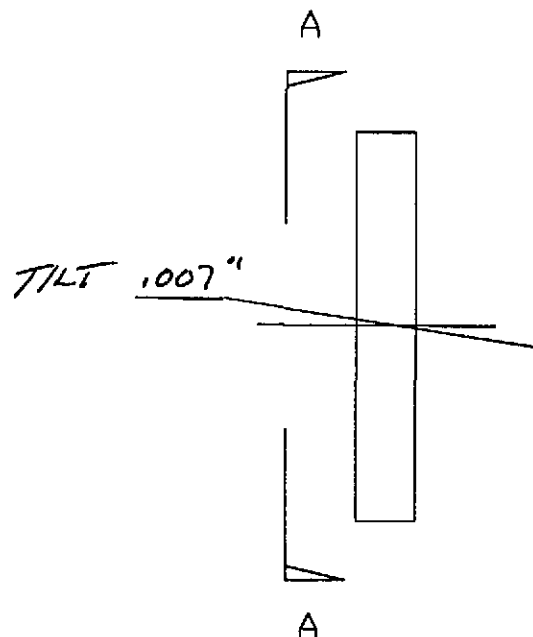
Comments:

Rework Required:

← TRUE NORTH



A-A



Component ID:

WGL 1

Serial No.:

BOLTED BETWEEN LA 313 AND
LA 313 EXISTING FLANGES SEE
CORRESPONDING ALIGNMENT RECORDS

Title:

GATE VALVE
INSTALLED POSITION

Job No.:

V59049

Project:

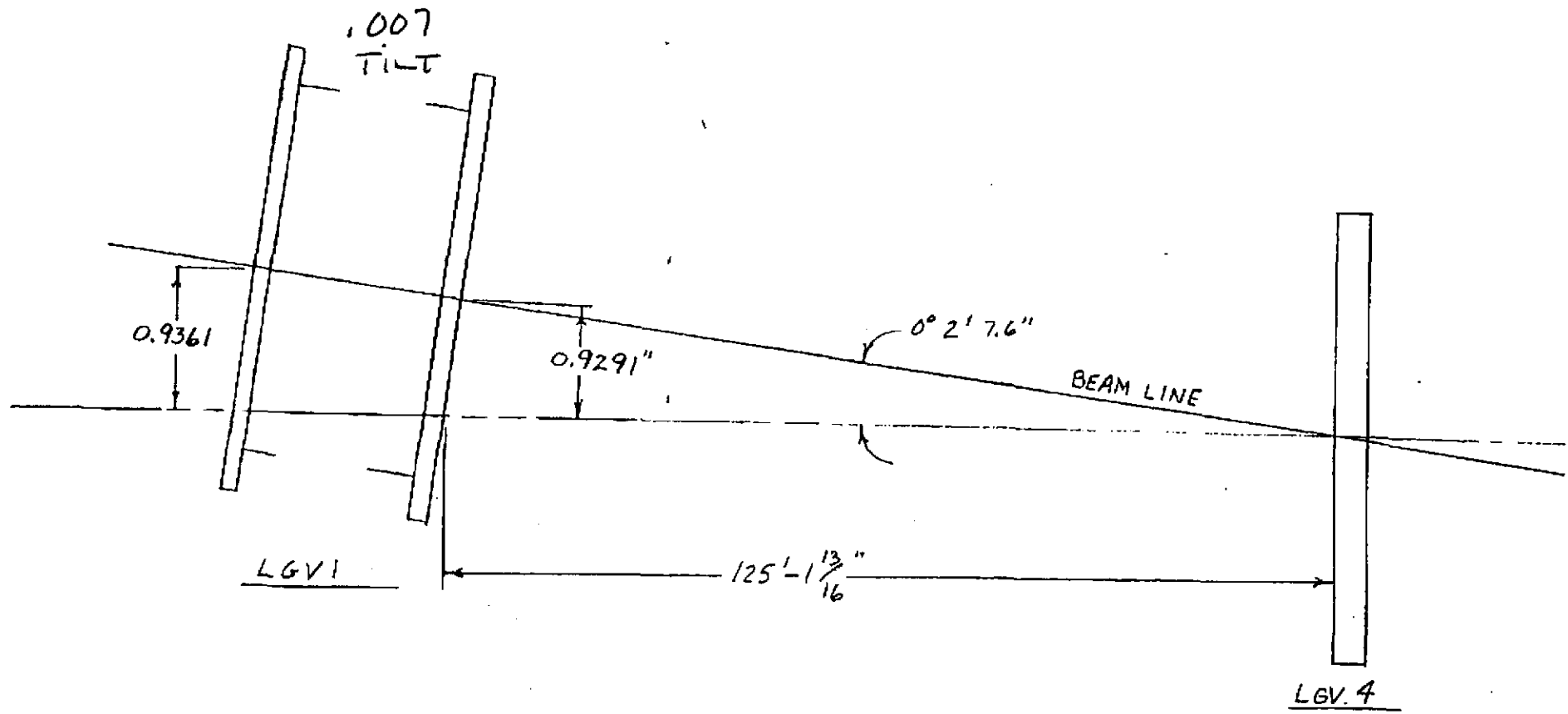
LIGO Equipment Set

Scale:

None

Dwn By:

BOLTED BETWEEN LA 313 AND LA 313 EXISTING FLANGES SEE CORRESPONDING ALIGNMENT RECORDS	Title: GATE VALVE INSTALLED POSITION	Job No.: <u>V59049</u>
	Project: LIGO Equipment Set	Scale: None Dwn By:



LIVINGSTON Y ARM

MON

DATE

7-27-98 CORNER

PAGE

80

GROUTED NAM-4 &
BSC-2.

SET GV-1 ON
"Y" ARM

VALVE MAN NO 1/4"
DRILL HOLES FOR &
REFERENCE.

ALLEN SIEBLY OK'ED
INSTALLING & LETTING
BOLTS ALIGN THE VALVE.
THE VALVE FIT WELL
& ALL BOLTS WERE RUN
IN BY HAND. VALVE
WAS PLUMB & TIGHTENE

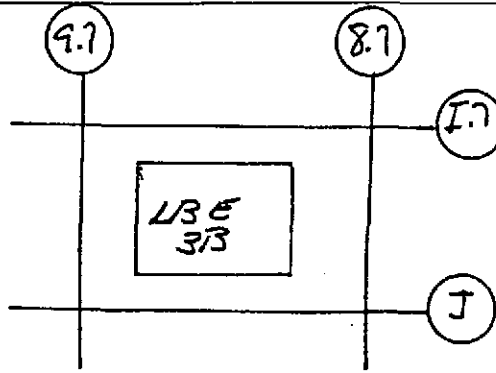
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBE-3B
 Component Name BELOW SPALL JOINING LHAM4 TO LBSC2
 Component S/N S/N 03
 Component Installation Weight (lb.) 2400#

Component Installation Position
(Ref. D Build Grid)

*NO ALIGNMENT
REQUIRES*



TRUE
NORTH

BLDG
NORTH ↑

Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	TDS	23 JUNE 98
	Buyer	ME	23 JUNE 98

SPECIFICATION

Number: A V049-2-174 Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LBE-3B

Component Name:

BELLOWS SPOOL JOINING LHAM4 TO LBE2

Component S/N:

S/N 03

Vacuum Sealing Surfaces Inspection

By:

JTS 23 JUNE 98

Buyer:

JTS JJ TUNSF

Cleanliness Inspection

By:

JTS 23 JUNE 98

Buyer:

JTS JJ TUNSF

O-Rings Installed

By:

JTS 23 JUNE 98

Buyer:

JTS JJ TUNSF

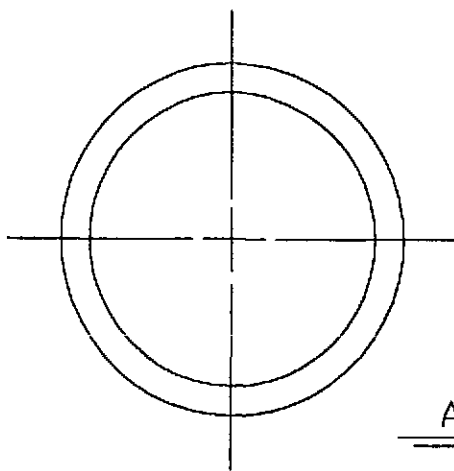
Bolt Torque

By:

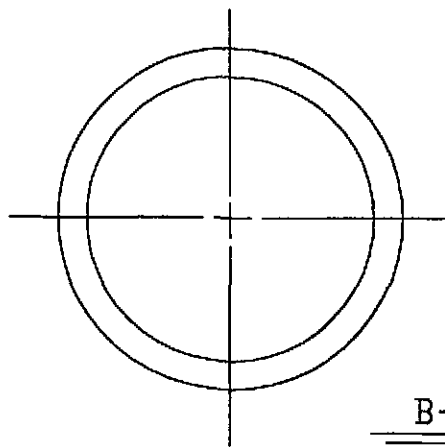
JTS 8-1-98

Comments:

Rework Required:

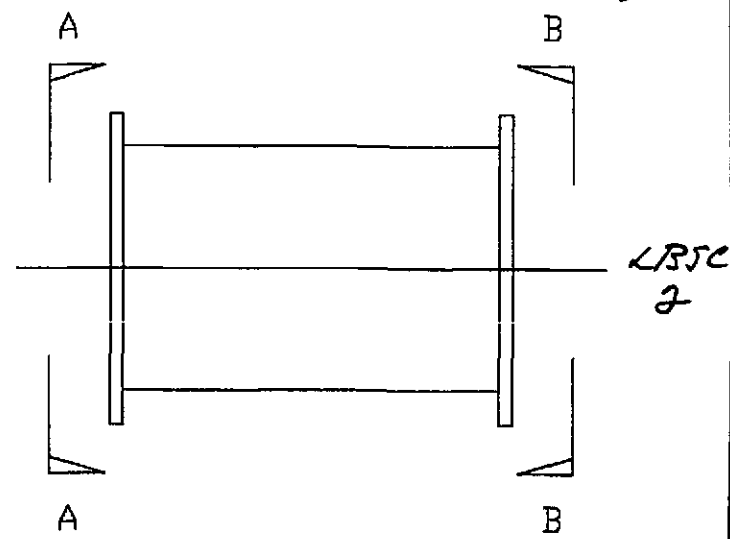


A-A



B-B

LHAM
4



← TRUE NORTH
BLDG NORTH
→

NO ALIGNMENT REQUIRED

Component ID: LRSC-3B

Serial No.: 03

	Title: SPOOL PIECE INSTALLED POSITION	Job No.: V59049	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

A/C IN & OUT ALL DAY
OUT @ 2:30 PM - NO IP.

SET SPOOL PIECE
LBE - 3B

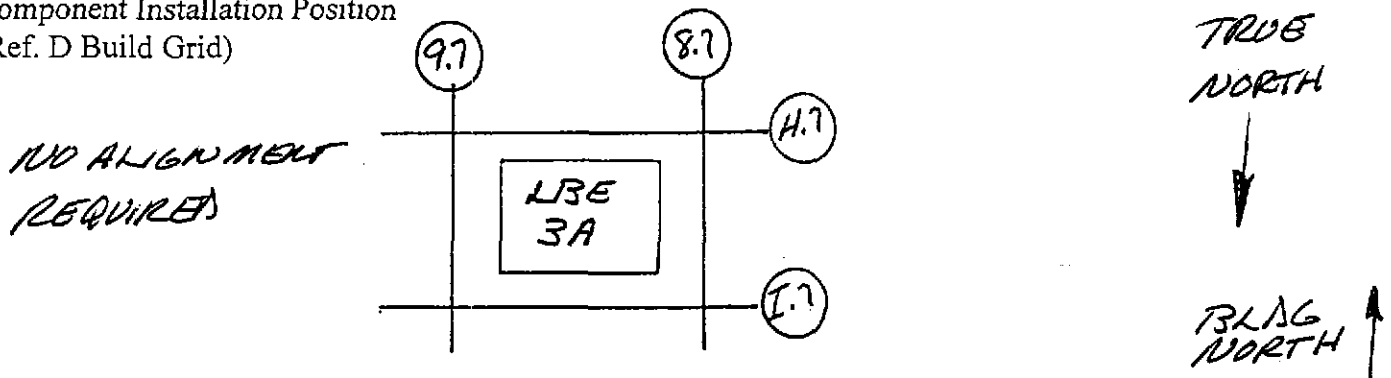
MOVED CLEAN ROOMS
TO NAM - 2-3

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBE-3A1
 Component Name BELOW'S SADDLE JOINTS LHAM3 TO LBSC2
 Component S/N S/N 03
 Component Installation Weight (lb.) 2400#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	N/A	
2.	Component Located For Anchor Bolt Marking	N/A	
	Buyer	N/A	
3.	Final Component Location Complete	<i>[Signature]</i>	20 JUNE 98
	Buyer	<i>[Signature]</i>	20 JUNE 98

SPECIFICATION	
Number:	Rev.
A V049-2-174	2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LBE-3A

Component Name:

BELLOWS SPOOL JOINING LHAM3 TO LBSK 2

Component S/N:

S/N03

Vacuum Sealing Surfaces Inspection

By:

JTS 20 JUNE 98

Buyer:

NIS 20 JUN 98

Cleanliness Inspection

By:

JTS 20 JUNE 98

Buyer:

NIS 20 JUN 98

O-Rings Installed

By:

JTS 20 JUNE 98

Buyer:

NIS 20 JUN 98

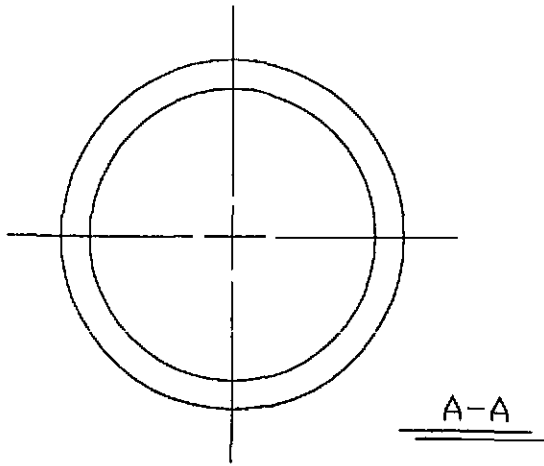
Bolt Torque

By:

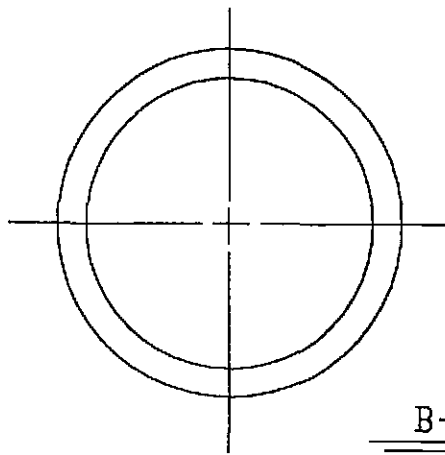
JTS 8-1-98

Comments:

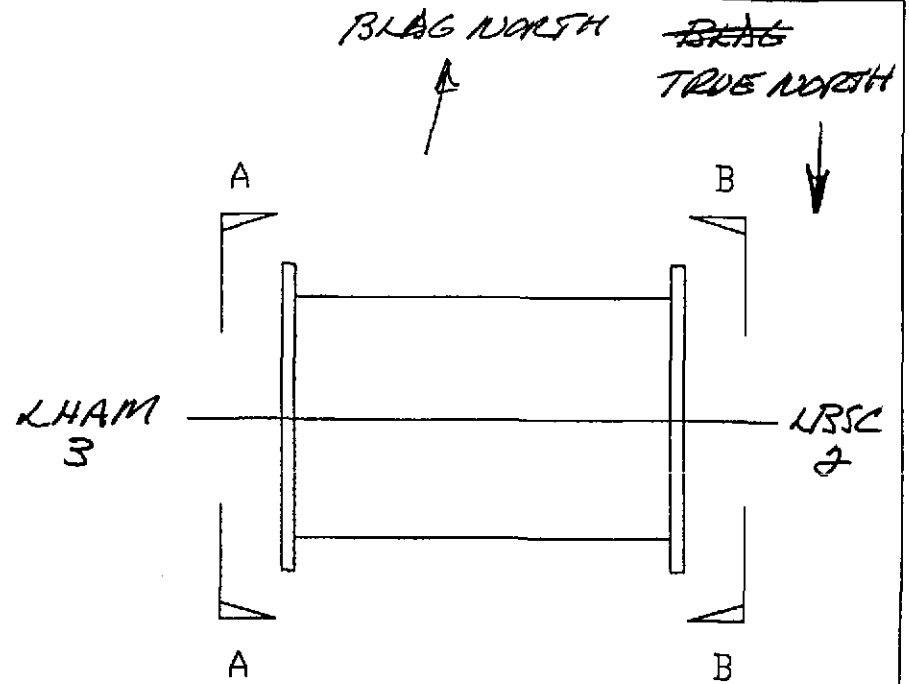
Rework Required:



A-A



B-B



NO ALIGNMENT REQUIRED

Component ID: LBE-3A1
 Serial No.: S/N 03

	Title: <u>SPool PIECE INSTALLED POSITION</u>	Job No.: <u>V55049</u>	
	Project: <u>LIGD Equipment Set</u>	Scale: <u>None</u>	Dwn By:

Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

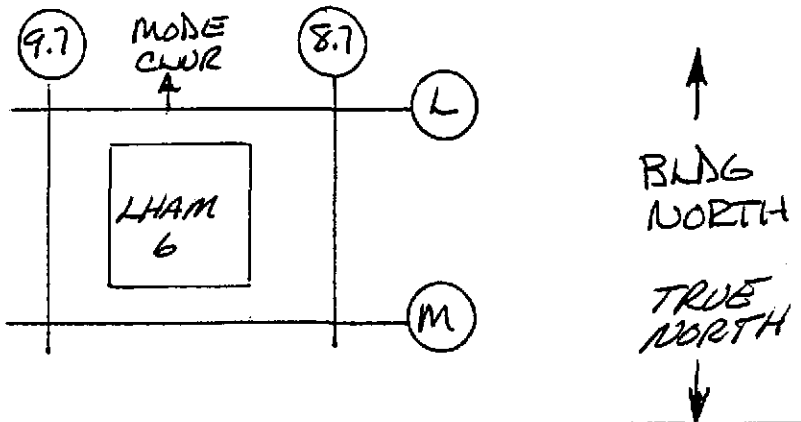
ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number LHAM-6
 Component Name HAM - LEFT ARM
 Component S/N S/N 19
 Component Installation Weight (lb.) 9000#

Component Installation Position
 (Ref. D Build Grid)

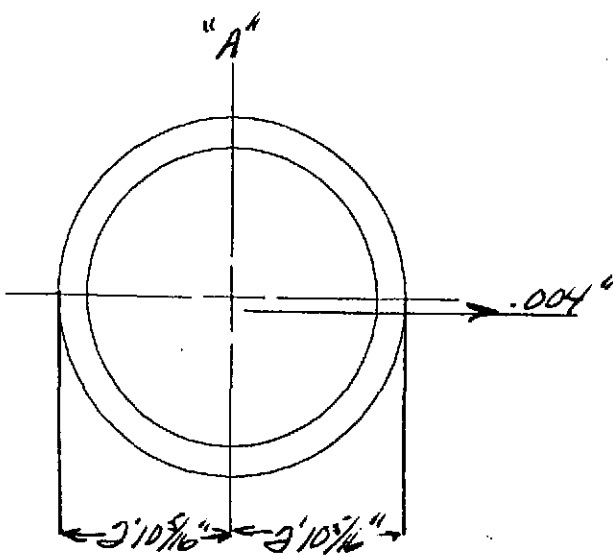
MEASUREMENT FROM THE NORTH
 FACE OF LHAM16 TO THE SOUTH
 FACE OF LHAM5 439"



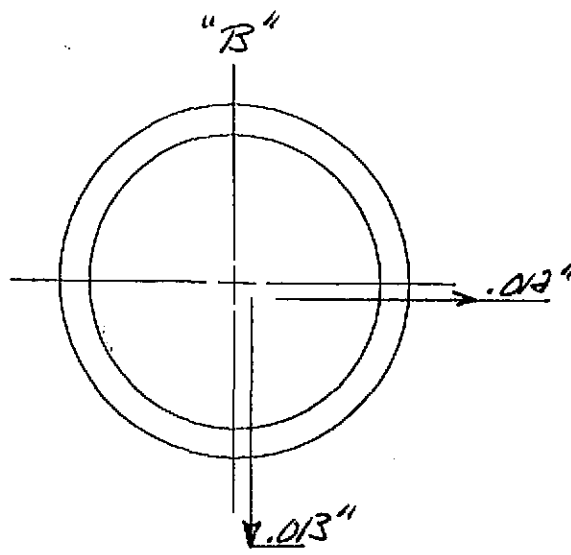
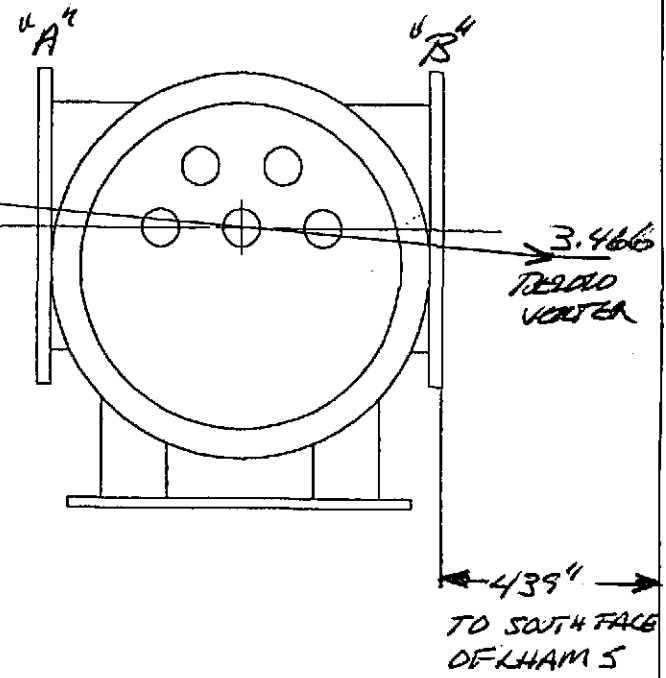
Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>JTS</i>	9 JUNE 98
2.	Component Located For Anchor Bolt Marking	<i>JTS</i>	9 JUNE 98
		Buyer <i>NUS</i>	9 JUN 98
3.	Final Component Location Complete	<i>JTS</i>	9 JUNE 98
		Buyer <i>NUS</i>	9 JUN 98

SPECIFICATION	
Number: A V049-2-174	Rev. 2

BLDG NORTH



TILT .055" 3.412 BELOW CENTER



Component ID: LHAM 6

Serial No.: S/N 019

TILT .055"

TILT .055"	Title: HORIZ. ACCESS MODULE INSTALLED POSITION	Job No.: V55049
	Project: LIGO Equipment Set	Scale: None Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 9 JUN 98	
Item Anchored: LHAM-6	No. of Anchors: 24	Size: 1"	Type: HAS

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TAS	N/A		9 JUN 98
Spacing & Location 1" x 16" (2)	TAS	N/A		↓
Anchor Size & Length 1" x 20 1/8" (4)	TAS	N/A		
Hole Size 1 1/8"	TAS	N/A		
Hole & Core Condition (no voids, etc.)	TAS	N/A		
Embedment (minus 0 plus 1/8") 8 1/4" - 13 3/8" (4)	TAS	N/A		
Angle (90 deg. ± 1 deg.)	TAS	N/A		
Floor Scarified	TAS	N/A		
Proper Nut Engagement	TAS	N/A		
Tightening	TAS	N/A		
Torque Device Identification: AP-9 250 FT. LBS	TAS	N/A		

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

ENDS OF ARM (PAA) 13 3/8" EMBEDMENTS

Inspection by: <i>N/A</i>	Date: 9 JUN 98
---------------------------	----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LHAM-6

Component Name:

HAM - LEFT ARM

Component S/N:

5/12 19

Vacuum Sealing Surfaces Inspection

By:

JTS 23 JUNE 98

Buyer:

MS 23 JUN 98

Cleanliness Inspection

By:

JTS 23 JUNE 98

Buyer:

MS 23 JUN 98

\-Rings Installed

By:

JTS 23 JUNE 98

Buyer:

MS 23 JUN 98

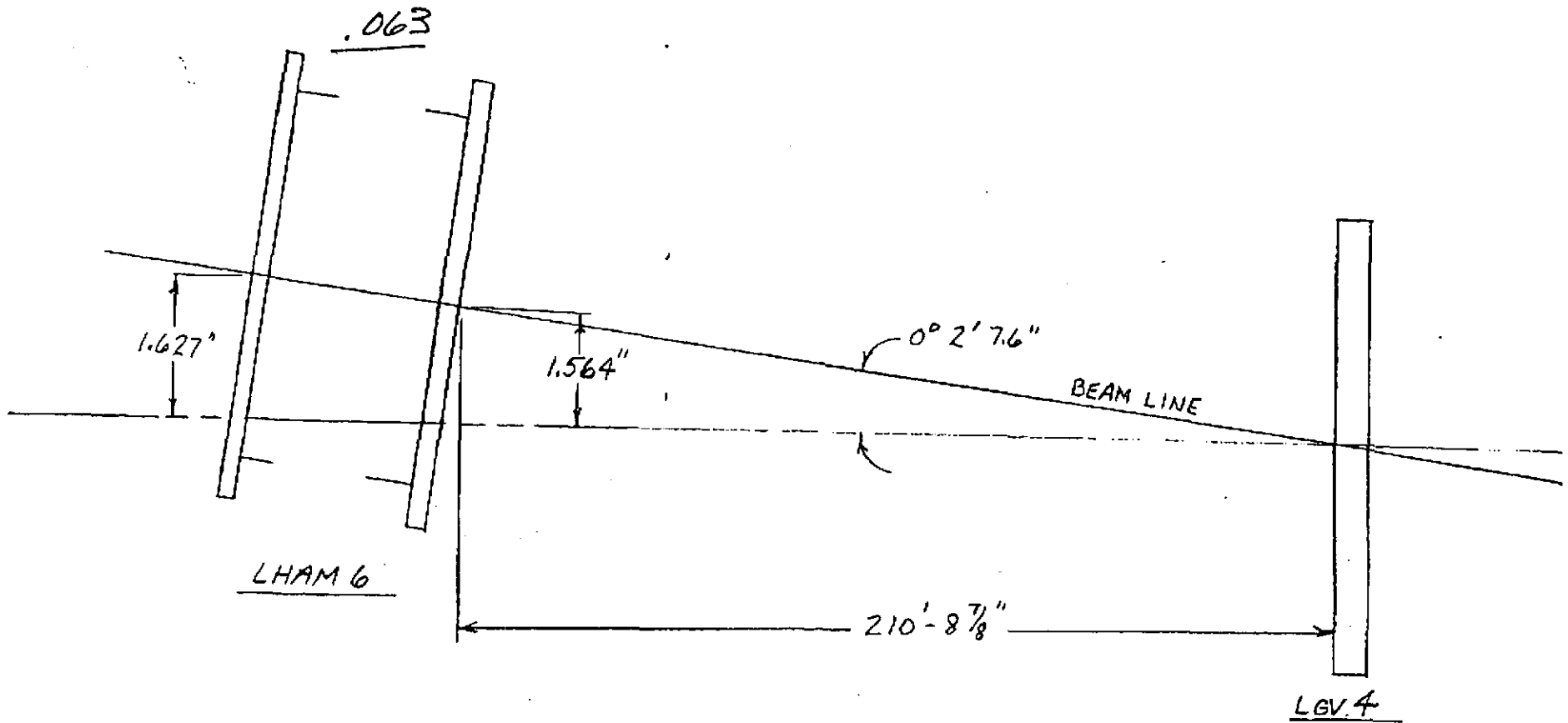
Bolt Torque

By:

JTS 8-1-98

Comments:

Rework Required:



LHAM 6

BEAM LINE

0° 2' 7.6"

1.627"

1.564"

210'-8 ⁷/₈"

LGV.4

LIVINGSTON Y ARM

EAST END @ .032"
South of @.

Difficult TO MATCH
VALVE LOCATION AND
REMAIN IN TOLERANCE
WITH WEST END, Bolt
BOUND ON FLANGE & VALVE,

USE .575 Below
VERTEX @ ~~East~~ FLANGE
OF CP-2 ELEVATION!

TUES

DATE 6/9/98

CORNER

PAGE # 71°

HAM-6 FINAL

B.S. END (South) IS
.013" WEST OF @.

NORTH END:

DUAL BOBS @ 2'10⁵/₁₆" ± .01

Elev: South Flg

3.937" DROP FROM BEAM

LINE

CALC. ELEV. 3.478"

ACTUAL 3.466

.012" High

SOUTH FLANGE @ 61'7"

FROM VERTEX @ .0076" PER FT.

.459" Rise

3.937 - .459 = 3.478

Below VERTEX
OVER

HAM ~~6~~ THIS IS OVER

NORTH FLAG @ 70' $\frac{3}{16}$ "
FROM VERTEX @ 00746
= .522"

$$3.937 - .522 = 3.415"$$

BELOW VERTEX

ACTUAL: .003" High

D.C. D. EVERS

SAT

DATE 6/6/98

CORNER ST.

PAGE # 71^o

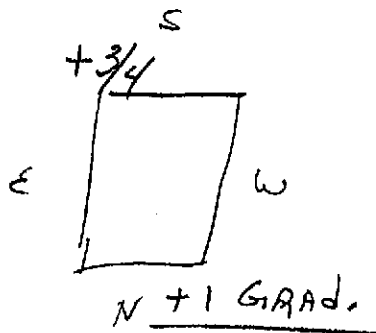
PRE BOLT SET HAM-6

☿ SOUTH FLANGE (B.S. END)
.003 EAST OF ☿

DUAL BOBS ON OTHER END
 $2' 2 \frac{57}{16} \pm .010$

ENDS + $\frac{1}{16}$ = $70' \frac{1}{4}$ "
CALC. $70' \frac{3}{16}$ "

Levelled w/ 98



Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

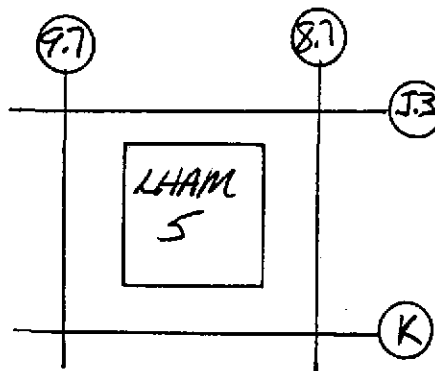
ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number LHAM-5
 Component Name HAM - LEFT ARM
 Component S/N S/N17
 Component Installation Weight (lb.) 9000#

Component Installation Position
 (Ref. D Build Grid)

MEASUREMENT FROM THE
 NORTH FACE OF LHAM5
 TO THE VERTEX 95'0"

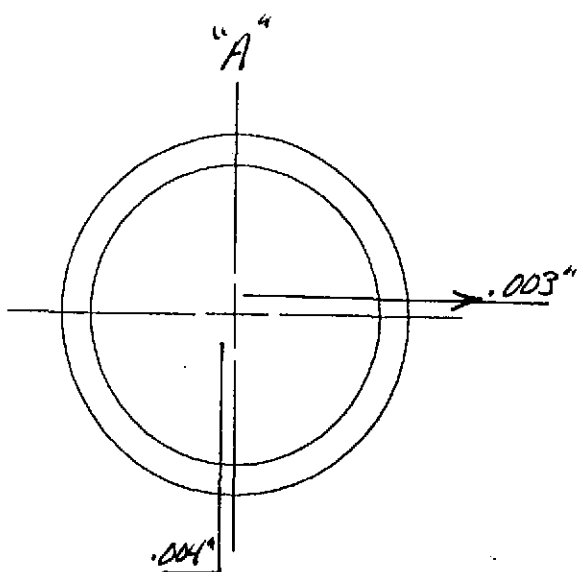


Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TRJ</i>	12 JUNE 98
2. Component Located For Anchor Bolt Marking	<i>TRJ</i>	12 JUNE 98
	Buyer <i>NVE</i>	13 JUN 98
3. Final Component Location Complete	<i>TRJ</i>	18 JUNE 98
	Buyer <i>NVE</i>	18 JUN 98

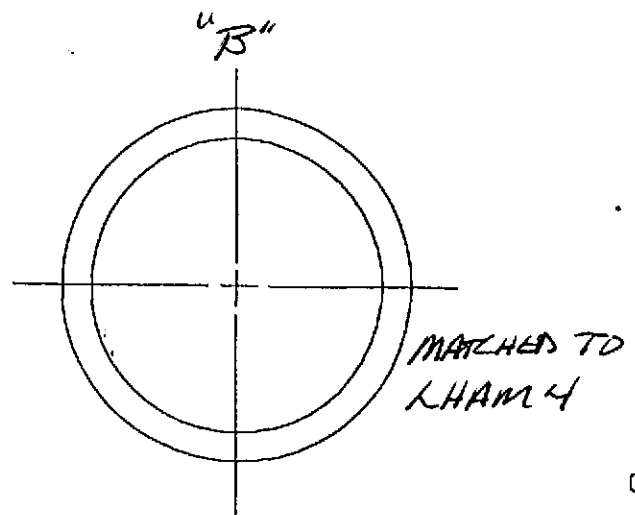
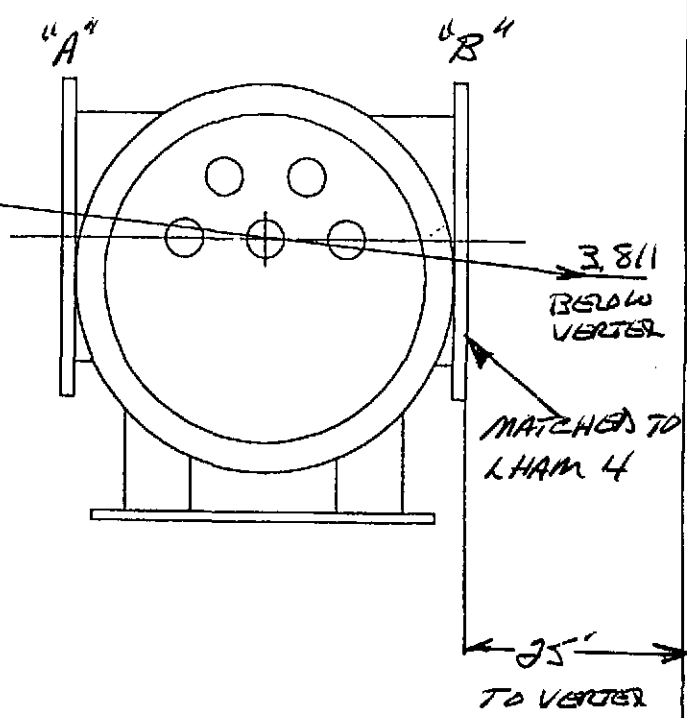
SPECIFICATION

Number: A V049-2-174 Rev. 2

BLDG NORTH
→



TILT .057" 3.754"
BELOW
VERTER



Component ID: LHAM 5
Serial No.: 5/10 017

TILT .057"

Title:	HORIZ- ACCESS MODULE INSTALLED POSITION	Job No.:	V55049
Project:	LIGO Equipment Set	Scale:	None
		Dwn By:	

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V55049	
Drawing: V049-5-003	Rev.: 3	Date: 13 JUN 98	
Item Anchored: LHAM-5	No. of Anchors: 24	Size: 1"	Type: HAS-STD

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	TJS	N/A		13 JUN 98
Spacing & Location	TJS	N/A		↓
Anchor Size & Length 1" x 15"	TJS	N/A		
Hole Size 1 1/8"	TJS	N/A		
Hole & Core Condition (no voids, etc.)	TJS	N/A		
Embedment (minus 0 plus 1/8") 8 1/4"	TJS	N/A		
Angle (90 deg. ± 1deg.)	TJS	N/A		
Floor Scarified	TJS	N/A		
Proper Nut Engagement	TJS	N/A		
Tightening	TJS	N/A		
Torque Device Identification: AP-9 250 FT LBS	TJS	N/A		
				16 JUN 98
				29 AUG 98

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <u>TJS</u>	Date: 13 JUN 98
---------------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LHAM-5

Component Name: HAM - LEFT ARM

Component S/N: S/N 17

Vacuum Sealing Surfaces Inspection

By: JTS 18 JUNE 98

Buyer: MSE 18 JUNE 98

Cleanliness Inspection

By: JTS 18 JUNE 98

Buyer: MSE 18 JUNE 98

O-Rings Installed

By: JTS 18 JUNE 98

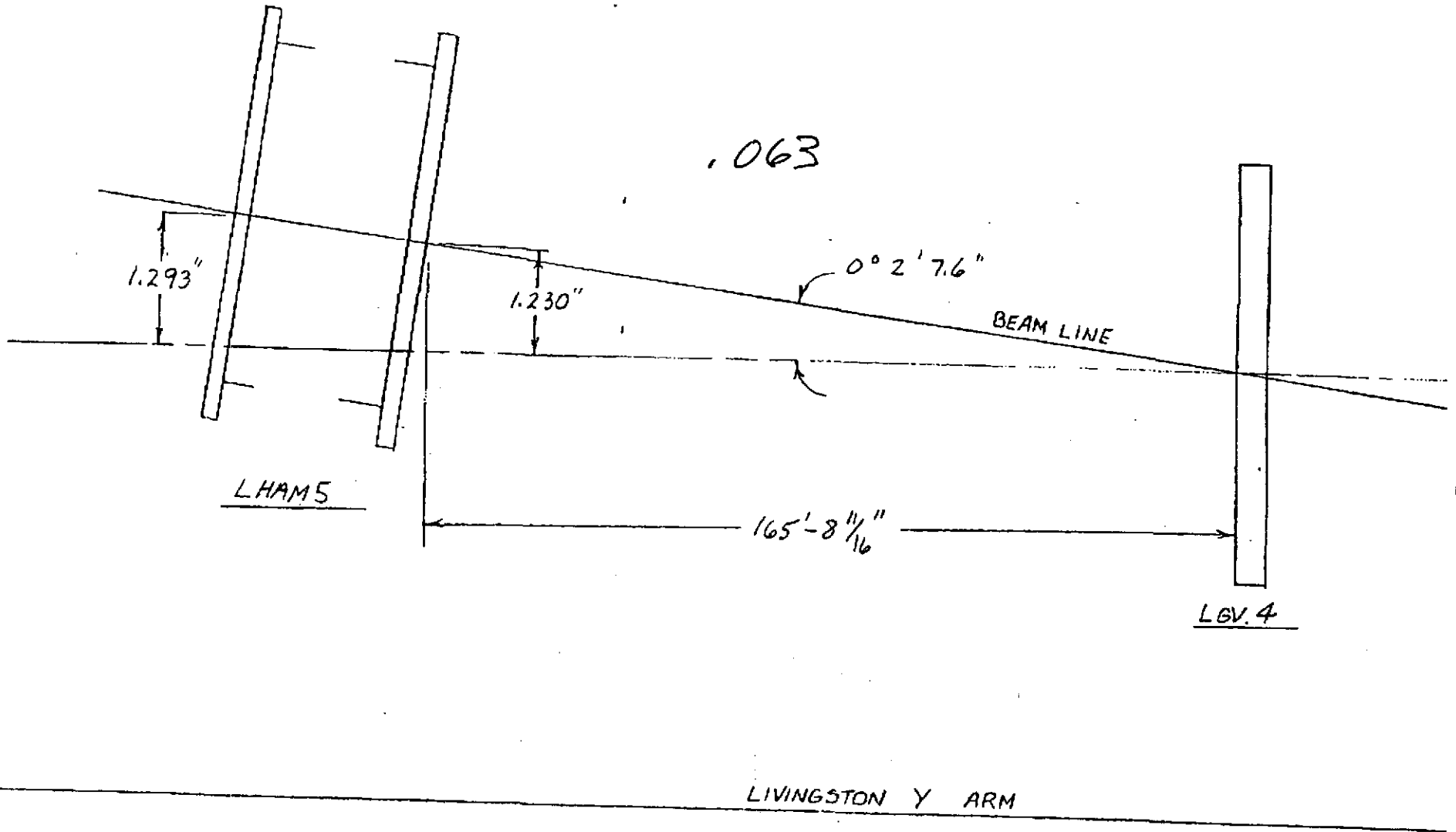
Buyer: MSE 18 JUNE 98

Bolt Torque

By: JTS 8-7-98

Comments:

Rework Required:



.063

1.293"

1.230"

0° 2' 7.6"

BEAM LINE

LHAM5

165'-8 1/16"

LGV.4

LIVINGSTON Y ARM

wed

DATE 6/17/98

CORNER ST.

PAGE # 71

HAM-5 FINAL .002

25' FROM NORTH FLANGE

VERTEX.

.186" ABOVE B.L.

3.937

-.186

3.751" BELOW VERTEX

ELEV: NORTH FLANGE

CALC: 3.751"

MEAS: 3.754"

NORTH FLANGE ϕ

.004" WEST OF ϕ

ENDS + $\frac{1}{8}$ " FROM VERTEX
LEVEL:

+ 2 OPPOSITE CORNERS

W/98,

DATE

6/12/98

CORNER ST

PAGE # 7

NAM-5 PRE BOLT

DUAL BOBS BOTH ENDS

2'10 1/4" I.D.D

ENDO + 1/16"

LEVEL:

+ 1 OPPOSITE CORNERS

D. EVERS Q.C.

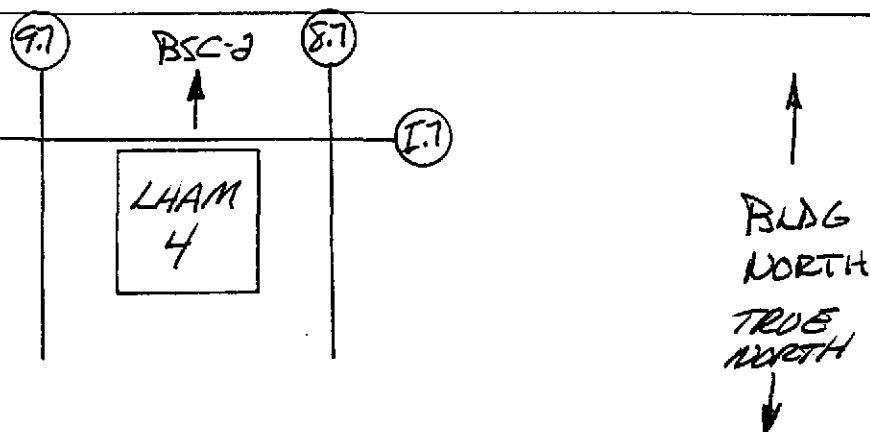
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LHAM-4
 Component Name HAM - LEFT ARM
 Component S/N S/N 16
 Component Installation Weight (lb.) 9000#

Component Installation Position
(Ref. D Build Grid)

MEASUREMENT FROM THE
NORTH FACE OF LHAM 4
TO THE VERTER 16'6 13/16"



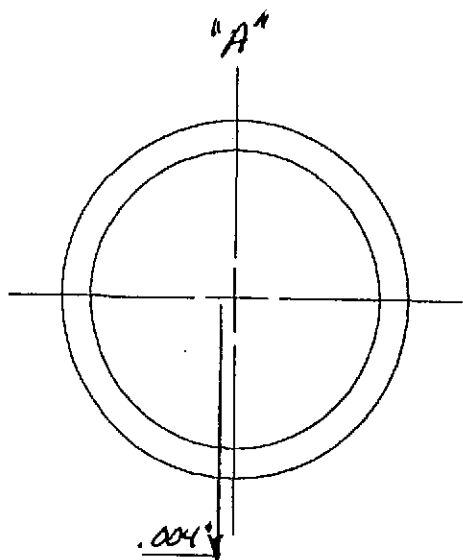
Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TOS</i>	11 JUNE 98
2. Component Located For Anchor Bolt Marking	<i>TOS</i>	11 JUNE 98
	Buyer <i>YSE</i>	11 JUN 98
3. Final Component Location Complete	<i>TOS</i>	15 JUNE 98
	Buyer <i>YSE</i>	15 JUN 98

SPECIFICATION

Number: A V049-2-174

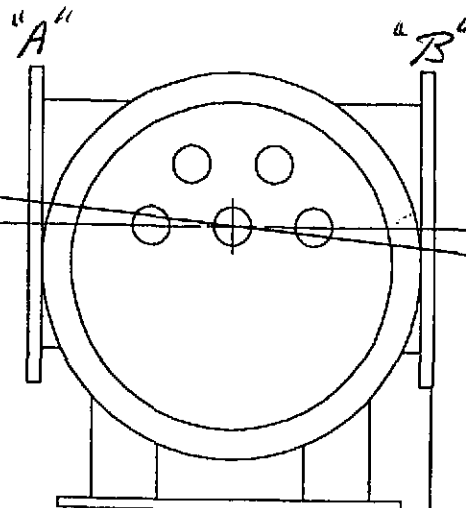
Rev. 2

BUILD NORTH →



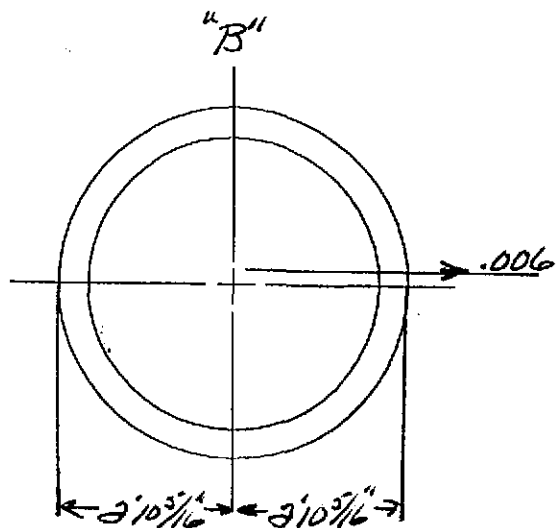
TILT .064°

3.811
BELOW
VERTEX



3.884
BELOW
VERTEX

16 13/16
TO VERTEX



Component ID:

LHAM 4

Serial No.:

5/10 016

TILT .064°

Title:

HORIZ. ACCESS MODULE
INSTALLED POSITION

Job No.:

V59049

Project:

LIGO Equipment Set

Scale:

None

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 11 JUN 98	
Item Anchored: LHAM 4	No. of Anchors 34	Size: 1"	Type: HAS

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super) HAS	TBS	N/A		11 JUN 98	
Spacing & Location	TBS	N/A		↓	
Anchor Size & Length 1" x 15"	TBS	N/A			
Hole Size 1"	TBS	N/A			
Hole & Core Condition (no voids, etc.)	TBS	N/A			
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	N/A			
Angle (90 deg. ± 1 deg.)	TBS	N/A			
Floor Scarified	TBS	N/A			12 JUN 98
Proper Nut Engagement	TBS	N/A			15 JUN 98
Tightening	LSMC	N/A			29 AUG 98

Torque Device Identification: AP-9 250 FT. LBS

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>N/A</i>	Date: 11 JUN 98
---------------------------	-----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LHAM-4

Component Name: HAM - LEFT ARM

Component S/N: S/N 16

Vacuum Sealing Surfaces Inspection

By: TKS 15 JUNE 98

Buyer: NSE 15 JUNE 98

Cleanliness Inspection

By: TKS 15 JUNE 98

Buyer: NSE 15 JUNE 98

O-Rings Installed

By: TKS 15 JUNE 98

Buyer: NSE 15 JUNE 98

Bolt Torque

By: NSE TKS 8-7-98

Comments:

Rework Required:

DATE 6/15/98 CORNER ST

PAGE # 21

HAM-4 ELEVATION

8' $\frac{15}{16}$ " FROM VERTEX TO SOUTH
FLANGE.

.060 ABOVE BEAM LINE
CALC: 3.877" BELOW VERTEX
MEAS: 3.884" " "

.007" ~~High~~ Low

16' $6\frac{13}{16}$ " VERTEX TO NORTH FL

.124" ABOVE BEAM LINE
CALC: 3.813" BELOW VERTEX
MEAS: 3.811" " "

.002" High

NORTH FLANGE ϕ

.004" WEST OF ϕ

DUAL BOBS SOUTH END

2' $10\frac{5}{16}$ " \pm .010

END

$\pm \frac{1}{16}$ " FROM VERTEX

NORTH FLANGE @ $20' \frac{3}{16}"$
FROM VERTEX @ 00746
= .522"

$$3.937 - .522 = 3.415"$$

Below VERTEX

ACTUAL: .003" High

Q.C. D. EVERS

wed

DATE 6/10/98

CORNER ST.

PAGE # 71⁰

NAM-4 PRE BOLT SET

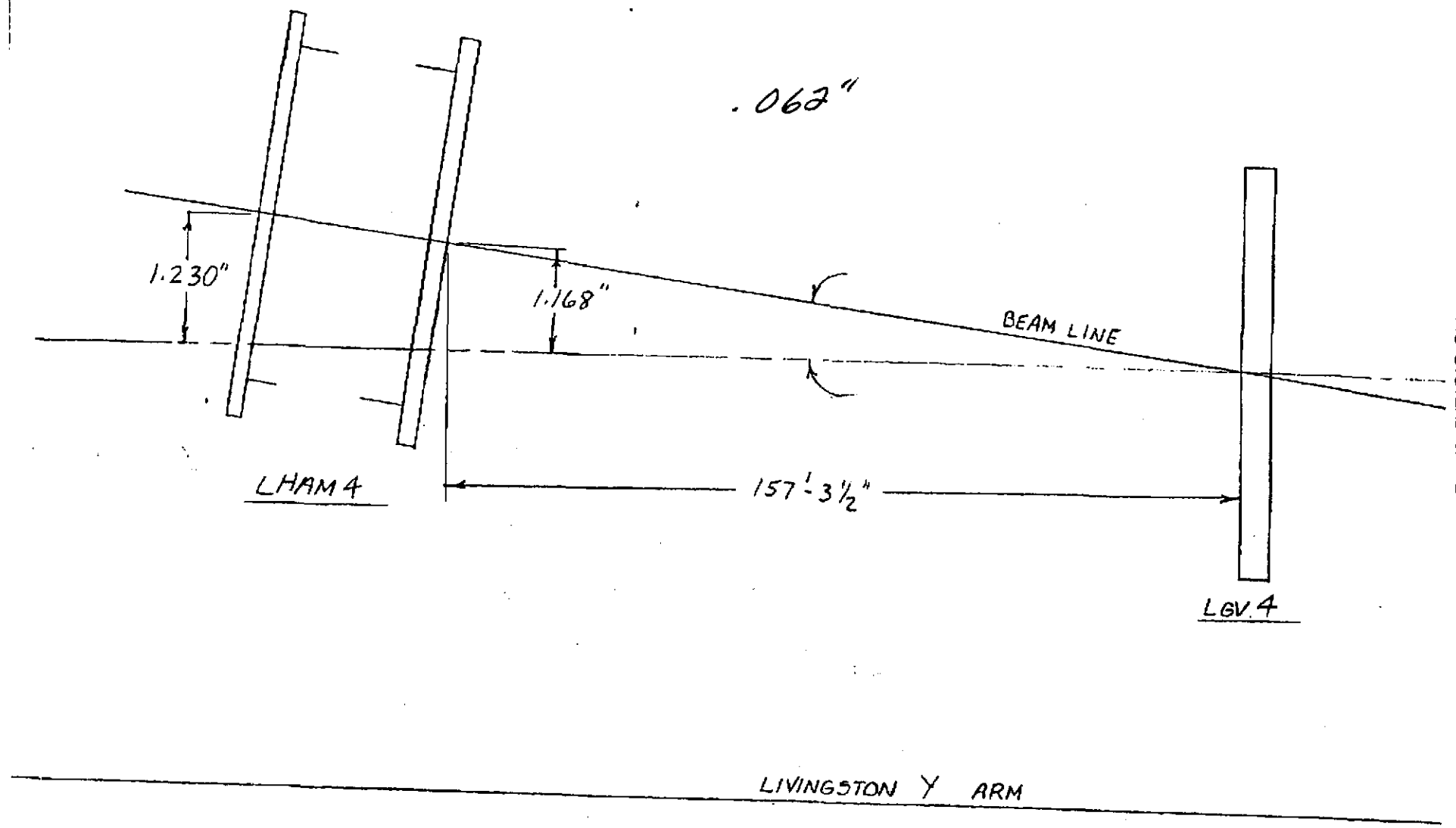
DUAL BOBS BOTH ENDS

$$2'10 \frac{5}{16}" \pm .010$$

ENDS $\frac{1}{16}"$ LONG FROM VERTEX

Q.C. DAVE EVERS

LEVELLED EW/98 ± 1 GRAD



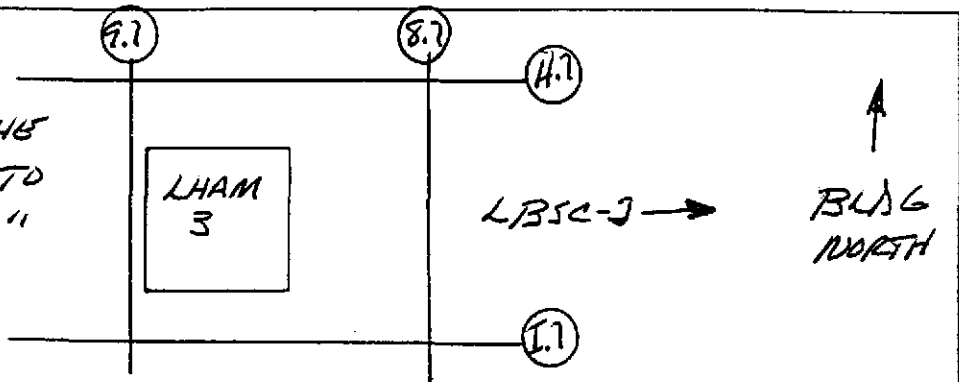
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LHAM-3
 Component Name HAM - RIGHT ARM
 Component S/N S/N 15
 Component Installation Weight (lb.) 9000#

Component Installation Position
(Ref. D Build Grid)

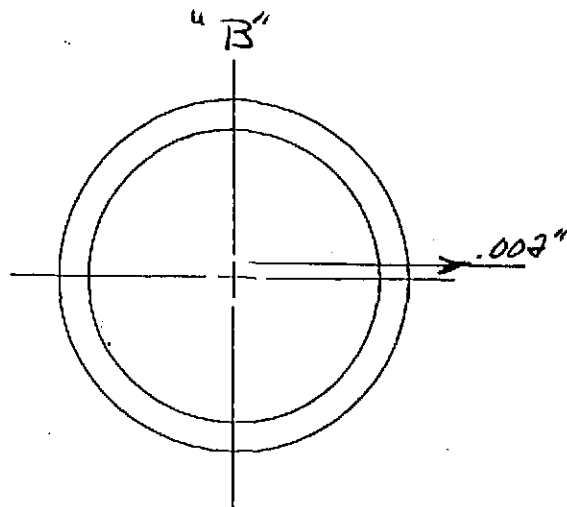
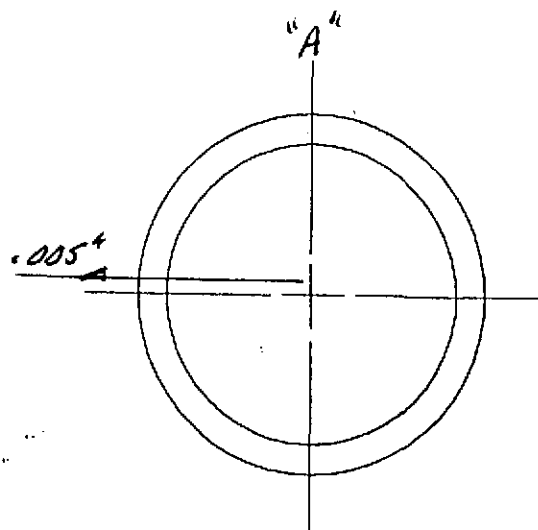
MEASUREMENT FROM THE
EAST FACE OF LHAM3 TO
THE VERTEX 16'6 3/16"



Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TGS</i>	12 JUNE 98
2. Component Located For Anchor Bolt Marking	<i>TGS</i>	12 JUNE 98
	Buyer <i>MS</i>	13 JUN 98
3. Final Component Location Complete	<i>TGS</i>	16 JUNE 98
	Buyer <i>MS</i>	16 JUN 98

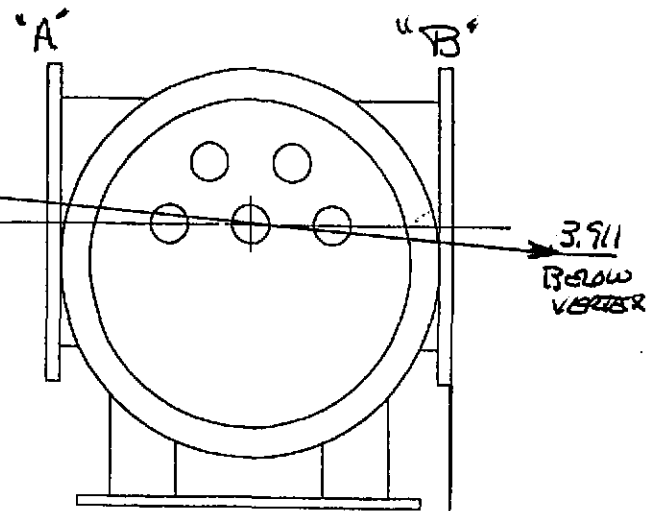
SPECIFICATION

Number: A V049-2-174 Rev. 2



TILT .032"

3.875
BELOW
VERTEX



BLDG
NORTH

3.911
BELOW
VERTEX

16 1/16
TO VERTEX

Component ID:

LHAM3

Serial No.:

S/N 15

	Title: HORIZ. ACCESS MODULE INSTALLED POSITION	Job No. <u>V59049</u>	
	Project: LIGO Equipment Set	Scale: None	Dwn By:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LHAM-3

Component Name: HAM - RIGHT ARM

Component S/N: S/N 15

Vacuum Sealing Surfaces Inspection

By: JCS 16 JUNE 98

Buyer: MS 16 JUN 98

Cleanliness Inspection

By: JCS 16 JUNE 98

Buyer: MS 16 JUN 98

O-Rings Installed

By: JCS 16 JUNE 98

Buyer: MS 16 JUN 98

Bolt Torque

By: JCS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

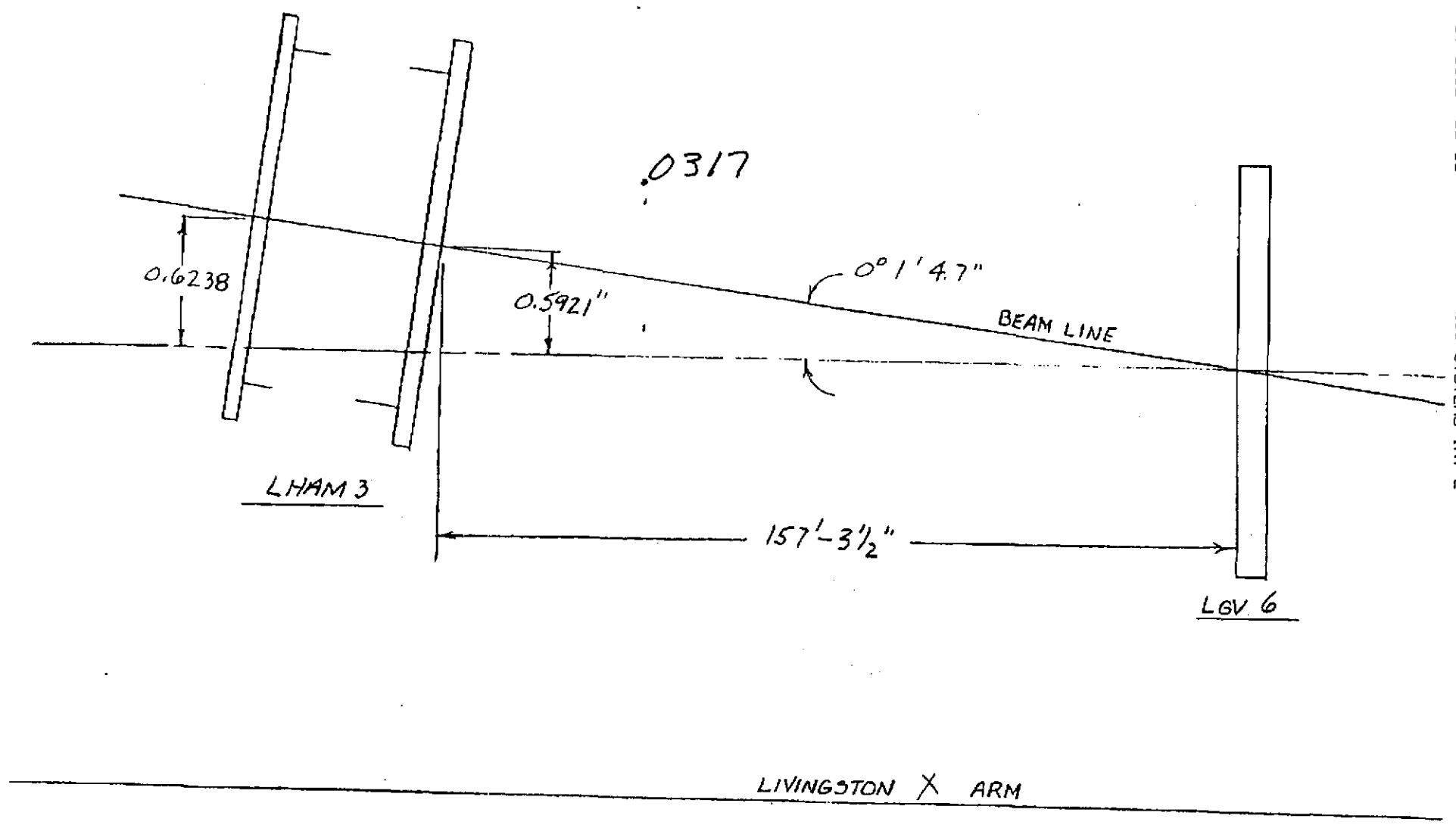
Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 13 JUN 98	
Item Anchored: 2 HAM-3	No. of Anchors 24	Size: 1"	Type: HAS-57A

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super)	TBS	NUS		13 JUN 98	
Spacing & Location	TBS	NUS		↓	
Anchor Size & Length 1" x 15"	TBS	NUS			
Hole Size 1"	TBS	NUS			
Hole & Core Condition (no voids, etc.)	TBS	NUS			
Embedment (minus 0 plus 1/8") 8 1/4"	TBS	NUS			
Angle (90 deg. ± 1 deg.)	TBS	NUS			
Floor Scarified	TBS	NUS			13 JUN 98
Proper Nut Engagement	TBS	NUS			15 JUN 98
Tightening	NUS	NUS			29 AUG 98
Torque Device Identification: AP-9 250 FT. LB!					

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>NUS</i>	Date: 13 JUN 98
---------------------------	-----------------



DATE 6/16/98 CORNER ST

PAGE # 70

NAM-3 .00376"/FT.

8' $\frac{15}{16}$ " FROM VERTEX TO WEST FLG

.028" ABOVE B.L.

3.937"

-.028

3.909" BELOW VERTEX

16' $6\frac{13}{16}$ " FROM VERTEX TO EAST FLG.

.062" ABOVE B.L.

3.937

-.062

3.875" BELOW VERTEX

.034" TILT

ENDO + $\frac{1}{16}$ " FROM VERTEX

WEST FLG ELEV

CALC: 3.909"

MEAS: 3.911"

EAST FLG: ELEV

CALC: 3.875"

MEAS: 3.883"

D. EVERS

G.C.

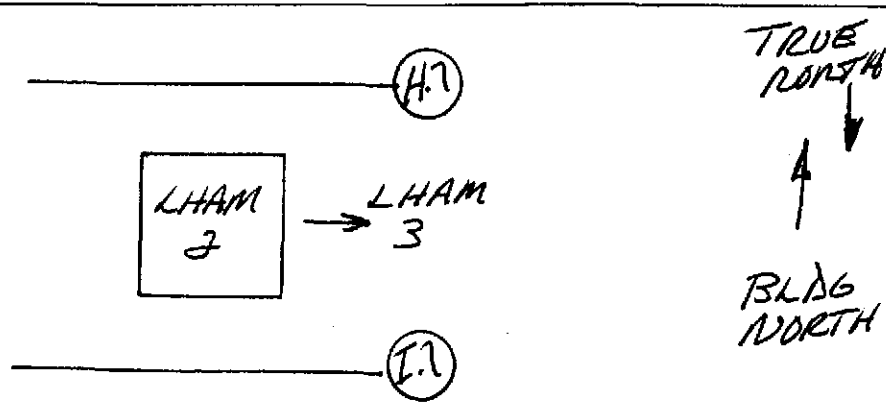
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number LHAM-3
Component Name HAM - RIGHT ARM
Component S/N S/N 14
Component Installation Weight (lb.) 9000#

Component Installation Position
(Ref. D Build Grid)



Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	TCS	13 JUNE 98
2.	Component Located For Anchor Bolt Marking	TCS	13 JUNE 98
		Buyer JWE	13 JUN 98
3.	Final Component Location Complete	TCS	18 JUNE 98
		Buyer JWE	18 JUN 98

SPECIFICATION

Number: A V049-2-174 Rev. 2

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LHAM-2

Component Name:

HAM - RIGHT ARM

Component S/N:

S/N 14

Vacuum Sealing Surfaces Inspection

By:

JTS 10 JUNE 98

Buyer:

NLS 18 JUNE 98

Cleanliness Inspection

By:

JTS 18 JUNE 98

Buyer:

NLS 18 JUNE 98

O-Rings Installed

By:

JTS 18 JUNE 98

Buyer:

NLS 18 JUNE 98

Bolt Torque

By:

JTS 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

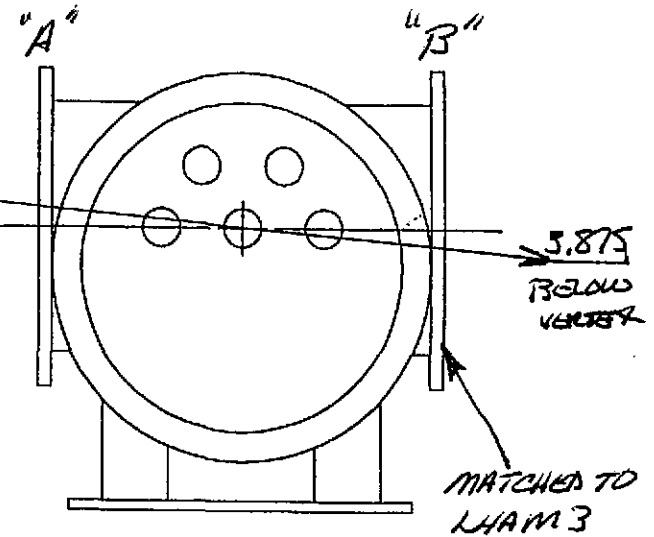
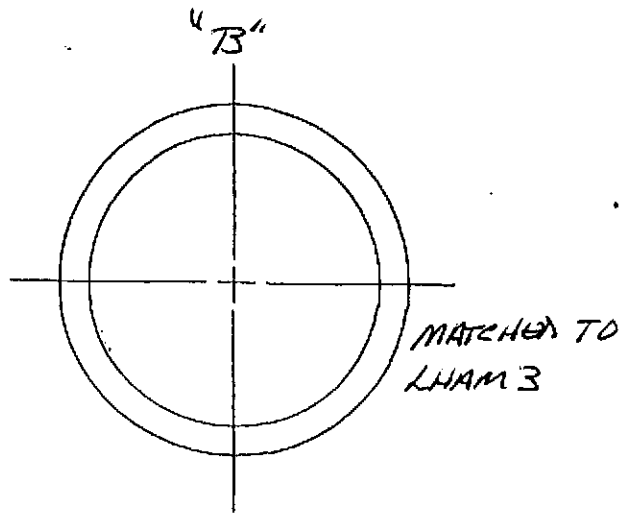
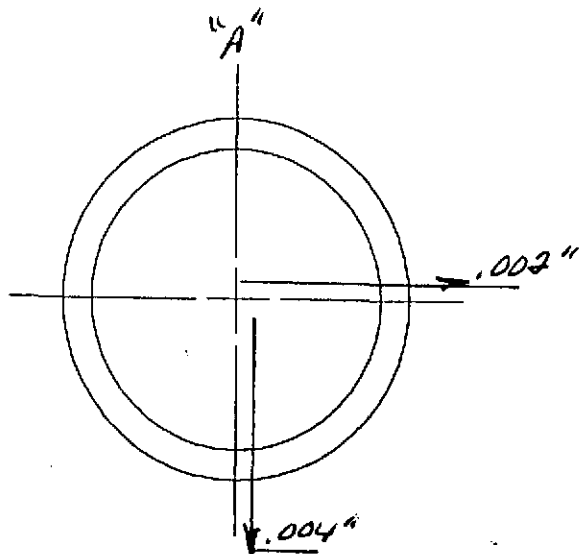
Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 13 JUN 98	
Item Anchored: LHAM-7	No. of Anchors 24	Size: 1"	Type: HAS-STB

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super)	JAS	N/A		15 JUN 98	
Spacing & Location	JAS	N/A		↓	
Anchor Size & Length 1" x 15"	JAS	N/A			
Hole Size 1 1/8"	JAS	N/A			
Hole & Core Condition (no voids, etc.)	JAS	N/A			
Embedment (minus 0 plus 1/8") 8 1/4"	JAS	N/A			
Angle (90 deg. ± 1 deg.)	JAS	N/A			
Floor Scarified	JAS	N/A			
Proper Nut Engagement	JAS	N/A			16 JUN 98
Tightening	JAS	N/A			17 JUN 98
Torque Device Identification: AP-9 350 FT.LBS.					25 AUG 98

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>JAS</i>	Date: 13 JUN 98
---------------------------	-----------------



BUDG
NORTH
↑

.033
TILT

3.843"
BELOW
VERTEX

3.875
BELOW
VERTEX

MATCHED TO
LHAM 3

OVERALL WIDTH OF LHAM 2
"A" TO "B" 1/16" LONG

Component ID: LHAM 2

Serial No.: 512 014

TILT .033"

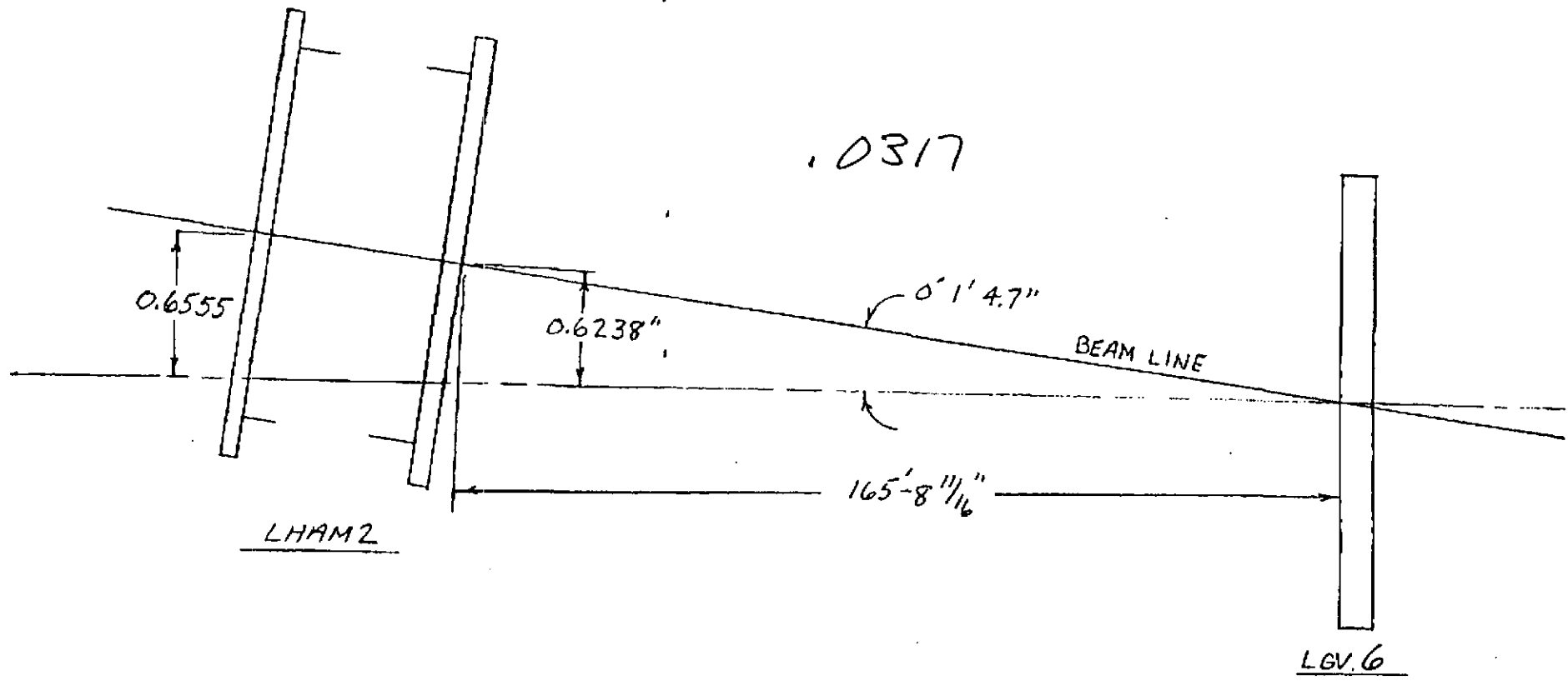
Title: HORIZ. ACCESS MODULE
INSTALLED POSITION

Job No.: V59049

Project: LIGO Equipment Set

Scale:
None

Dwn By:



.0317

LIVINGSTON X ARM

THUR

DATE

6/18/98 CORNER ST

73-

PAGE #

HAM-2 FINAL SET
25' FROM VERTEX TO
EAST FLANGE.

EAST FLANGE ELEV.

.002" LOW

CALC: 3.843" BELOW VERTE

.094" RISE

.032" TILT

MEAS 3.845"

EAST FLANGE ϕ .

.004 SOUTH OF ϕ

WEST FLANGE

MATED UP TO EAST
FLANGE ON HAM-3
LEVELLED + 1 GRAD
OPPOSITE CORNERS.

END ϕ + $\frac{1}{16}$ "

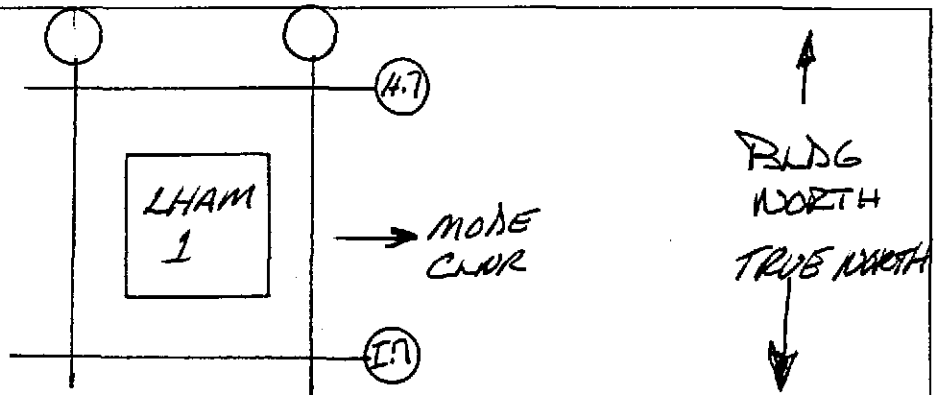
Title: **LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE**

**ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET**

Component Tag Number LHAM - 1
 Component Name LHAM - RIGHT ARM
 Component S/N 5/12/18
 Component Installation Weight (lb.) 9000#

Component Installation Position
 (Ref. D Build Grid)

MEASUREMENT FROM THE
 EAST FACE OF LHAM 1
 TO THE WEST FACE OF
 LHAM 3 439"

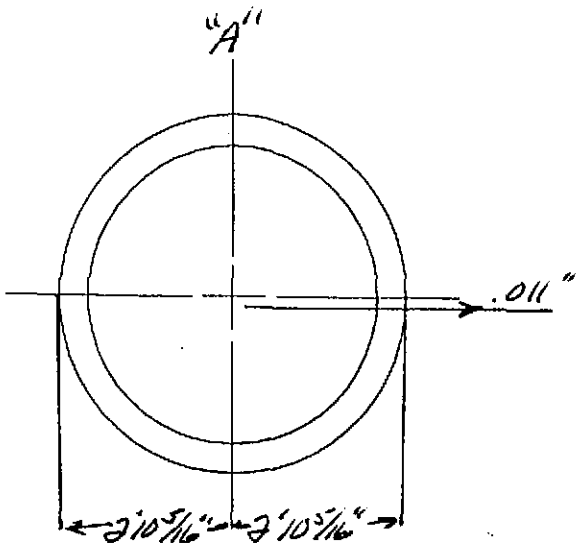


Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	<i>TCS</i>	9 JUNE 98
2. Component Located For Anchor Bolt Marking	<i>TCS</i>	9 JUNE 98
	Buyer <i>ME</i>	9 JUN 98
3. Final Component Location Complete	<i>TCS</i>	10 JUNE 98
	Buyer <i>ME</i>	10 JUN 98

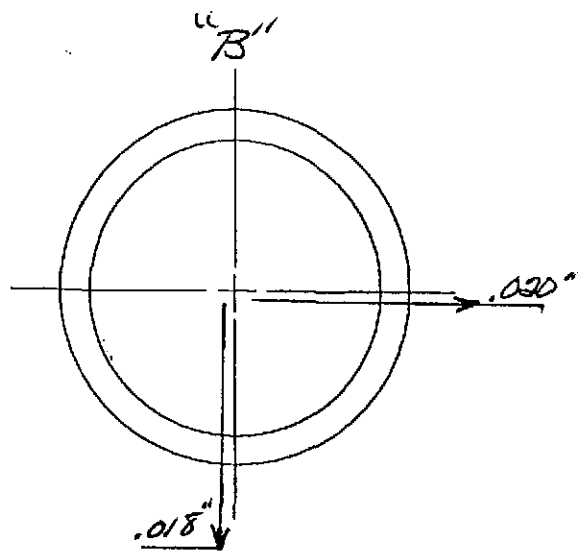
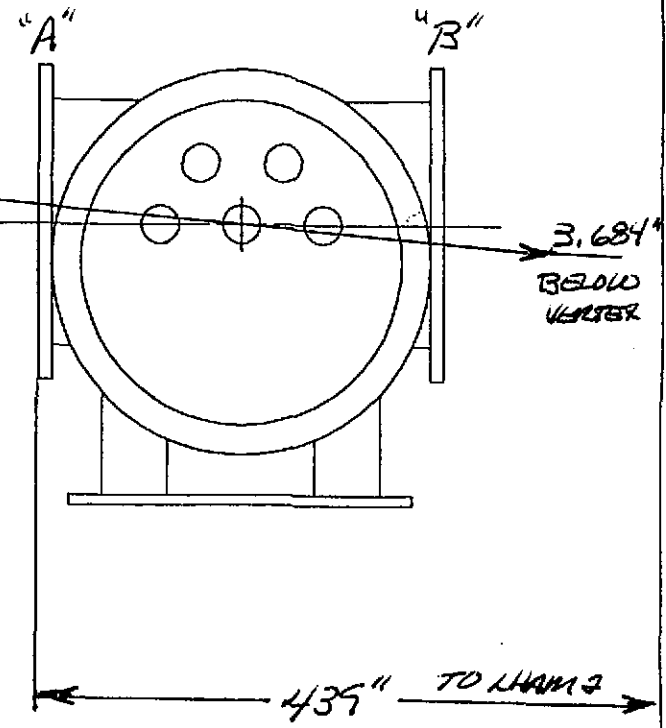
SPECIFICATION

Number: **A V049-2-174** Rev. **2**

ASDG
NORTH
↑



TILT .031" 3.663"
BELOW
VERTER



Component ID: LHAM 1
Serial No.: S/N 018

TILT .031"
CONTROL ELEV 3 5/16" BELOW VERTER

Title: HORIZ. ACCESS MODULE
INSTALLED POSITION
Project: LIGO Equipment Set

Job No.: V59049
Scale: None
Dwn By:

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LHAM 1

Component Name:

HAM - RIGHT ARM

Component S/N:

S/N 18

Vacuum Sealing Surfaces Inspection

By:

DTL 20 JUNE 98

Buyer:

NTE 20 JUN 98

Cleanliness Inspection

By:

DTL 20 JUNE 98

Buyer:

NTE 20 JUN 98

O-Rings Installed

By:

DTL 20 JUNE 98

Buyer:

NTE 20 JUN 98

Bolt Torque

By:

DTL 8-1-98

Comments:

Rework Required:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 9 JUN 98	
Item Anchored: LHAM-1	No. of Anchors 24	Size: 1"	Type: HAS

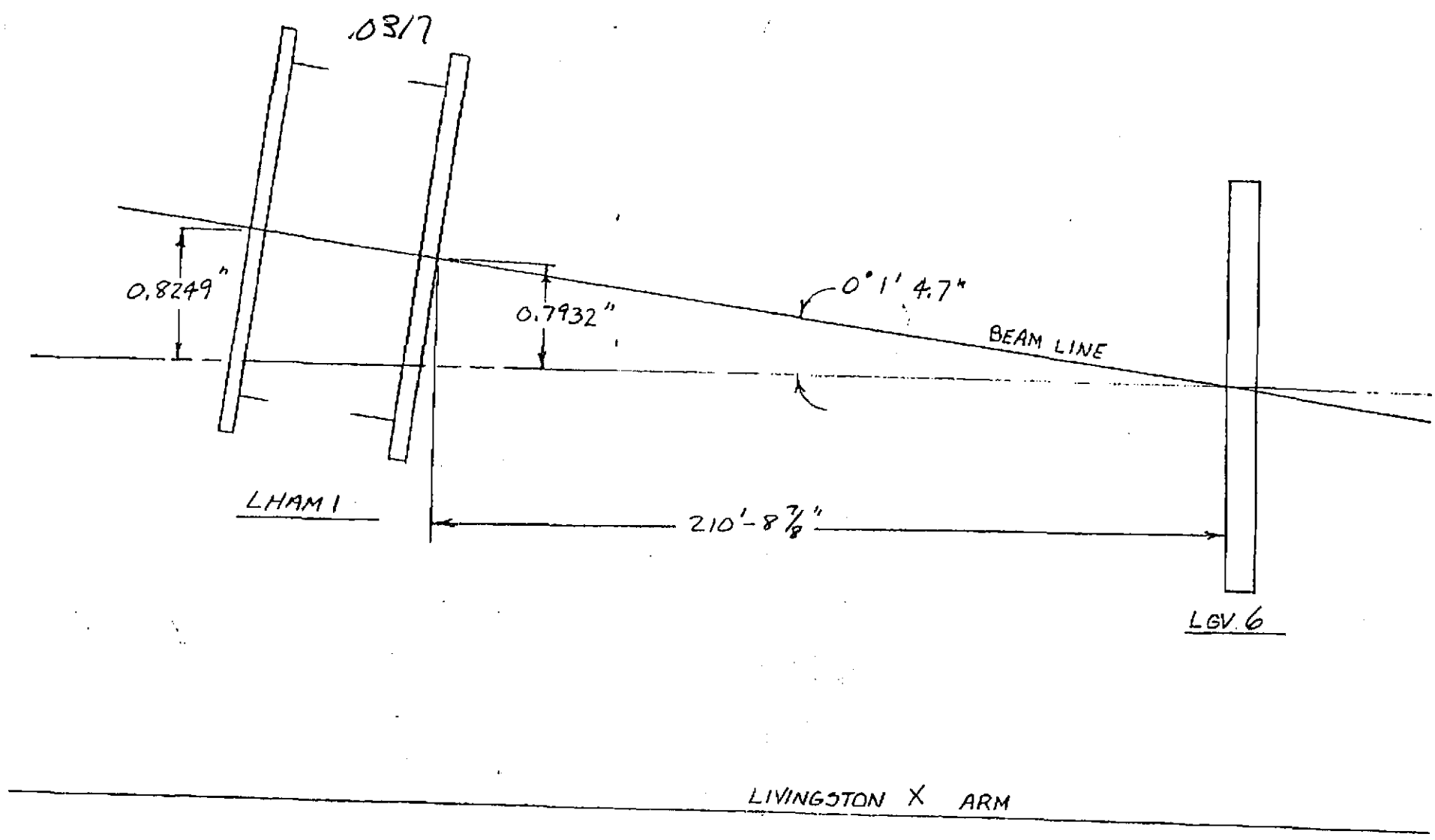
Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or Super)	JTS	MSE		9 JUN 98
Spacing & Location	JTS	MSE		↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
Anchor Size & Length 1" x 20 1/8" - 16"	JTS	MSE		
Hole Size 1 1/8"	JTS	MSE		
Hole & Core Condition (no voids, etc.)	JTS	MSE		
Embedment (minus 0 plus 1/8") 8 1/4" - 12 3/8" (4)	JTS	MSE		
Angle (90 deg. ± 1 deg.)	JTS	MSE		
Floor Scarified	JTS	MSE		
Proper Nut Engagement	JTS	MSE		
Tightening	JTS MSE	MSE		
Torque Device Identification: AP-9 850 FT. LBS				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

END OF ARM (PAD) 12 3/8" EMBEDMENT

Inspection by: <u>MSE</u>	Date: 9 JUN 98
---------------------------	----------------



wed
DATE 6/10/98 CORNER ST.

PAGE # 71

HAM-1 FINAL SET
CALC:

EAST ELEV: 3.674

BELOW VERTEX

WEST 3.704

ϕ B.S. END IS
.018" SOUTH OF ϕ
OPPOSITE END:

DUAL BOBS

2'10 $\frac{5}{16}$ " \pm .010

ACTUAL ELEV:

BS END: .020" High

3.684" Below VERTEX

EAST END: .011 High

3.663" Below VERTEX

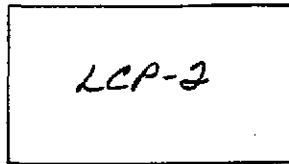
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LCP-2 / LBE4B
 Component Name CRYOPUMP - RIGHT ARM
 Component S/N S/N 7 / S/N 10
 Component Installation Weight (lb.) 13000#

Component Installation Position
(Ref. D Build Grid)

MEASUREMENT FROM THE WEST
FACE OF LCP2 TO THE WEST
FACE OF LGV6 343 1/8"
(-1/8")



↑
BLDG
NORTH

→
LGV-6
(36")

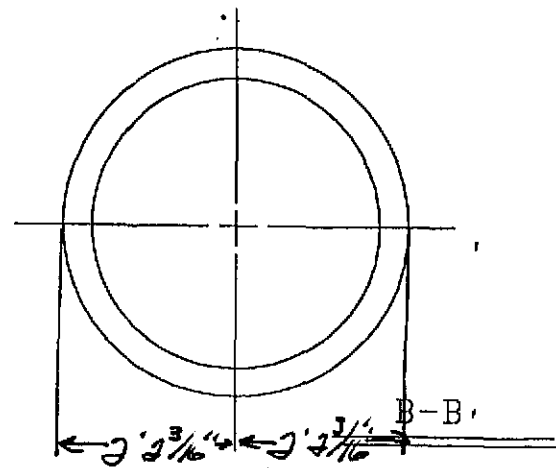
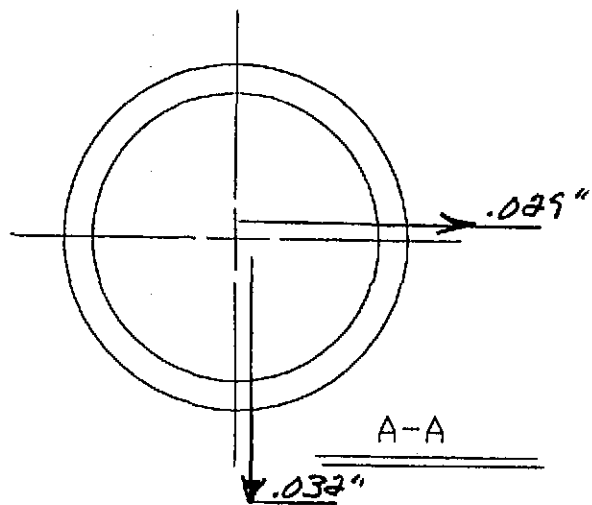
↓
TRUE
NORTH

Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	TJS	6 JUNE 98
2. Component Located For Anchor Bolt Marking	TJS	6 JUNE 98
	Buyer NUS - PH	6 JUN 98
3. Final Component Location Complete	TJS	6 JUNE 98
	Buyer NUS	8 JUN 98

SPECIFICATION

Number: A V049-2-174

Rev. 2



TILT .064

.582
BELOW
VERTEX

BUNG
NORTH

B

.646
BELOW
VERTEX

(.566
+.080
=.646)

LGV6

243 7/8"
(-1/8")

Component ID: LCP 2/LBE4B

Serial No.: 5/10 02/5/10 10

	①	②	△
Calc			
Shot			

BSAM TUBE VALVE LGV6 SHOT
.080" LDW

TILT .064"

Title: .CRYO PUMP
INSTALLED POSITION

Job No.: V59049

Project: LIGD Equipment Set

Scale: None

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 6 JUN 98	
Item Anchored: LCP 2	No. of Anchors 16	Size: 1"	Type: SUPER

Attribute	a. Installer	b. Accepted	c. N/A	d. Date
Anchor Type (HAS Std or <u>Super</u>)	<i>JMS</i>	<i>NLS</i>		6 JUN 98
Spacing & Location	<i>JMS</i>	<i>NLS</i>		
Anchor Size & Length 1" x 19 1/8"	<i>JMS</i>	<i>NLS</i>		
Hole Size 1 1/8"	<i>JMS</i>	<i>NLS</i>		
Hole & Core Condition (no voids, etc.)	<i>JMS</i>	<i>NLS</i>		
Embedment (minus 0 plus 1/8") 12 3/8"	<i>JMS</i>	<i>NLS</i>		
Angle (90 deg. ± 1 deg.)	<i>JMS</i>	<i>NLS</i>		
Floor Scarified	<i>JMS</i>	<i>NLS</i>		8 JUN 98
Proper Nut Engagement	<i>JMS</i>	<i>NLS</i>		8 JUN 98
Tightening	<i>JMS</i>	<i>NLS</i>		29 JUN 98
Torque Device Identification: AP-9 400 FT. LBS.				

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>[Signature]</i>	Date: 6 JUN 98
-----------------------------------	-----------------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LCP-2 / L3E4B

Component Name:

CR40 PUMP - RIGHT ARM

Component S/N:

S/N 7 / S/N 10

Vacuum Sealing Surfaces Inspection

By:

JTS

8 JUNE 98

Buyer:

ME

8 JUN 98

Cleanliness Inspection

By:

JTS

8 JUNE 98

Buyer:

ME

8 JUN 98

-Rings Installed

By:

JTS

8 JUNE 98

Buyer:

ME

8 JUN 98

Bolt Torque

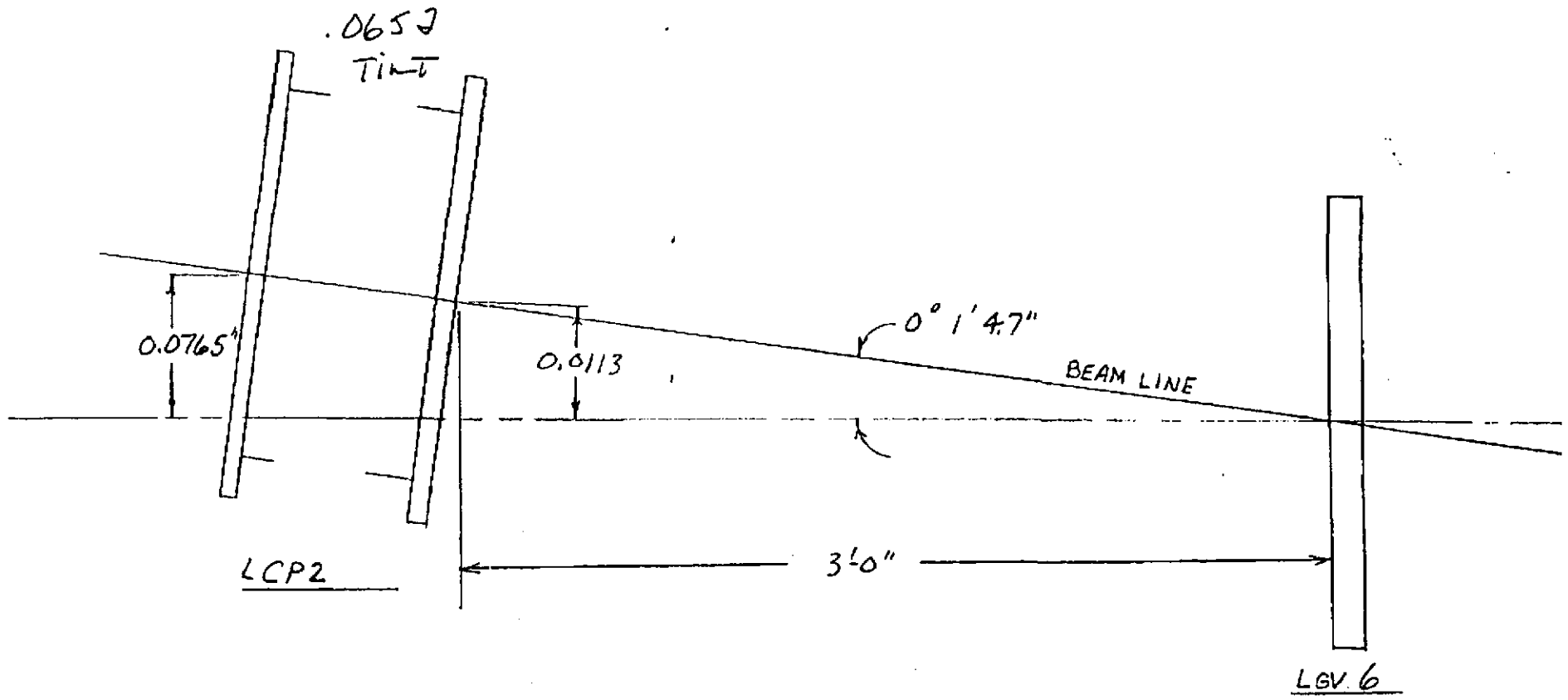
By:

JTS

8-4-98

Comments:

Rework Required:



LIVINGSTON X ARM

MONDAY

DATE 6/8/98

CORNER ST

PAGE # 70

USE (.00427 INCL
CP-2 FINAL SET

GV-6 IS .080" LOW

PER MY VERTEX ELEV.

{ 20'4" @ .00376 = .076"
TILT ACROSS CP-2.

.566 DROP FROM VERTEX TO GV.

SET PUMP EAST END (BSC-2 END)

@ .522" BELOW VERTEX

CALC: .491"

.566

- .076

.490

ACTUAL ELEV .582"
BELOW. \approx .030 LOW. FROM CALC
WITH LOW VALUE CORRECTION.

VALVE END ϕ WITH DUAL BOBS

2'2 $\frac{3}{16}$ " \pm .010

END O

$\frac{1}{8}$ " TOO CLOSE TO VALVE
OVER.

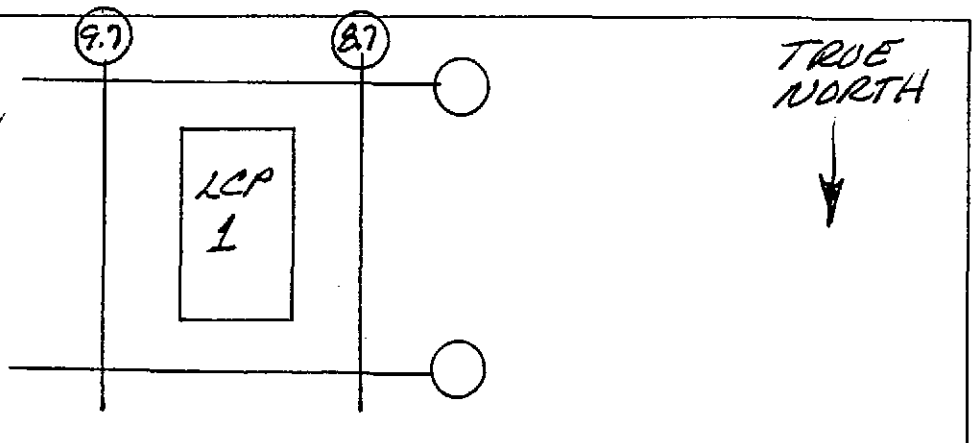
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LCP-1 / LBEC
 Component Name CR40PUMP - LEFT ARM
 Component S/N S/N 02 / S/N 11
 Component Installation Weight (lb.) 13000#

Component Installation Position
(Ref. D Build Grid)

MEASURE FROM THE SOUTH
FACE OF LGV4 TO THE
SOUTH FACE OF LCP 1
20'4" (+1/16")

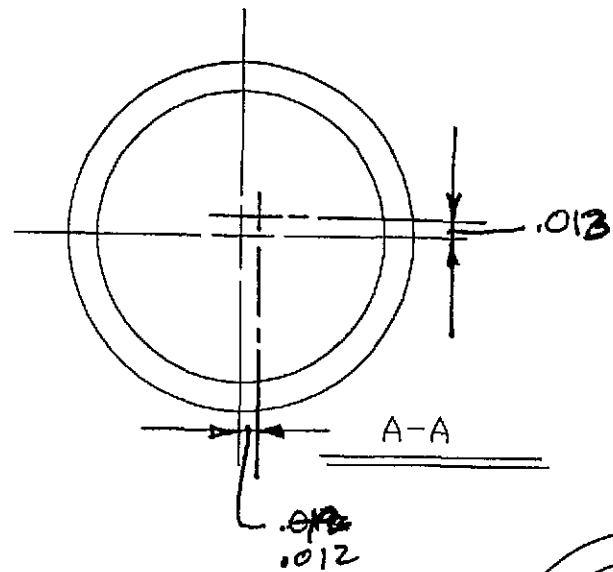


Signoffs (Contractor Unless Otherwise Noted)		By	Date
1.	Shipping Cover Cross Hairs Verified	<i>TCS</i>	1 JULY 98
2.	Component Located For Anchor Bolt Marking	<i>TCS</i>	1 JULY -98
	Buyer	<i>MSE</i>	1 JUL 98
3.	Final Component Location Complete	<i>TCS</i>	7 July 98
	Buyer	<i>MSE</i>	7 JUL 98

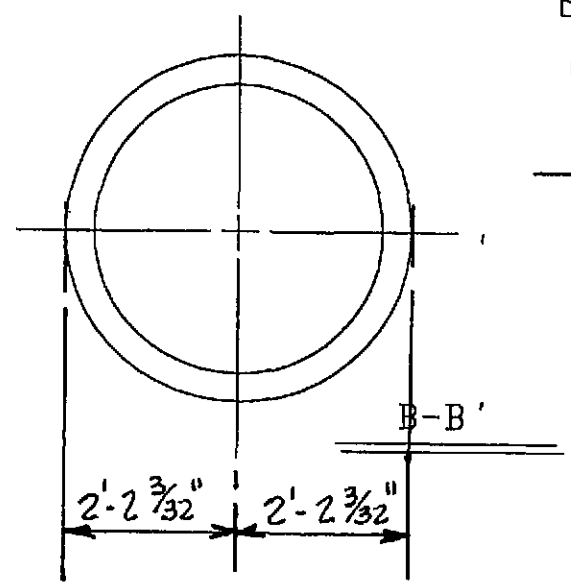
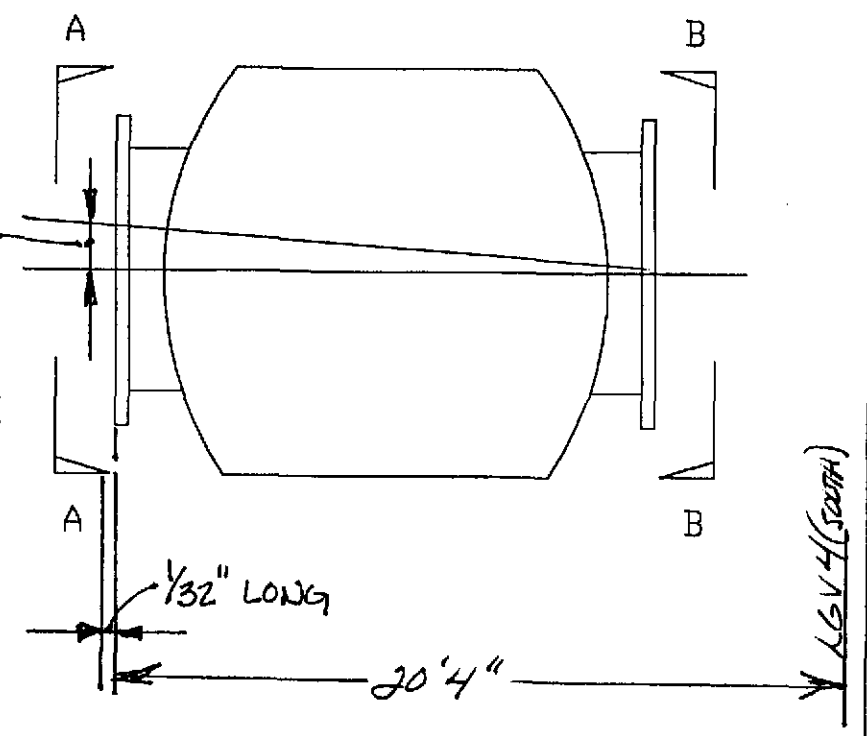
SPECIFICATION

Number:	Rev.
A V049-2-174	2

← TRUE NORTH



ACTUAL = .164
CAL. = .152
.961
BELOW
VERTEX



Component ID: LCP-1/LBE4C
Serial No.: 5/10 02/s/w 11

	①	②	△
Calc			
Shot			

CORNER STN

	Title: CRYO PUMP INSTALLED POSITION	Job No.: V59049
	Project: LIGO Equipment Set LA	Scale: None

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number: LCP-1 / LRE4C

Component Name: CRYOPUMP - LEFT ARM

Component S/N: S/N 02 / S/N 11

Vacuum Sealing Surfaces Inspection

By: TDS 7 July 98

Buyer: NSE 7 JUL 98

Cleanliness Inspection

By: TDS 7 July 98

Buyer: NSE 7 JUL 98

\Rings Installed

By: TDS 7 JULY 98

Buyer: NSE 7 JUL 98

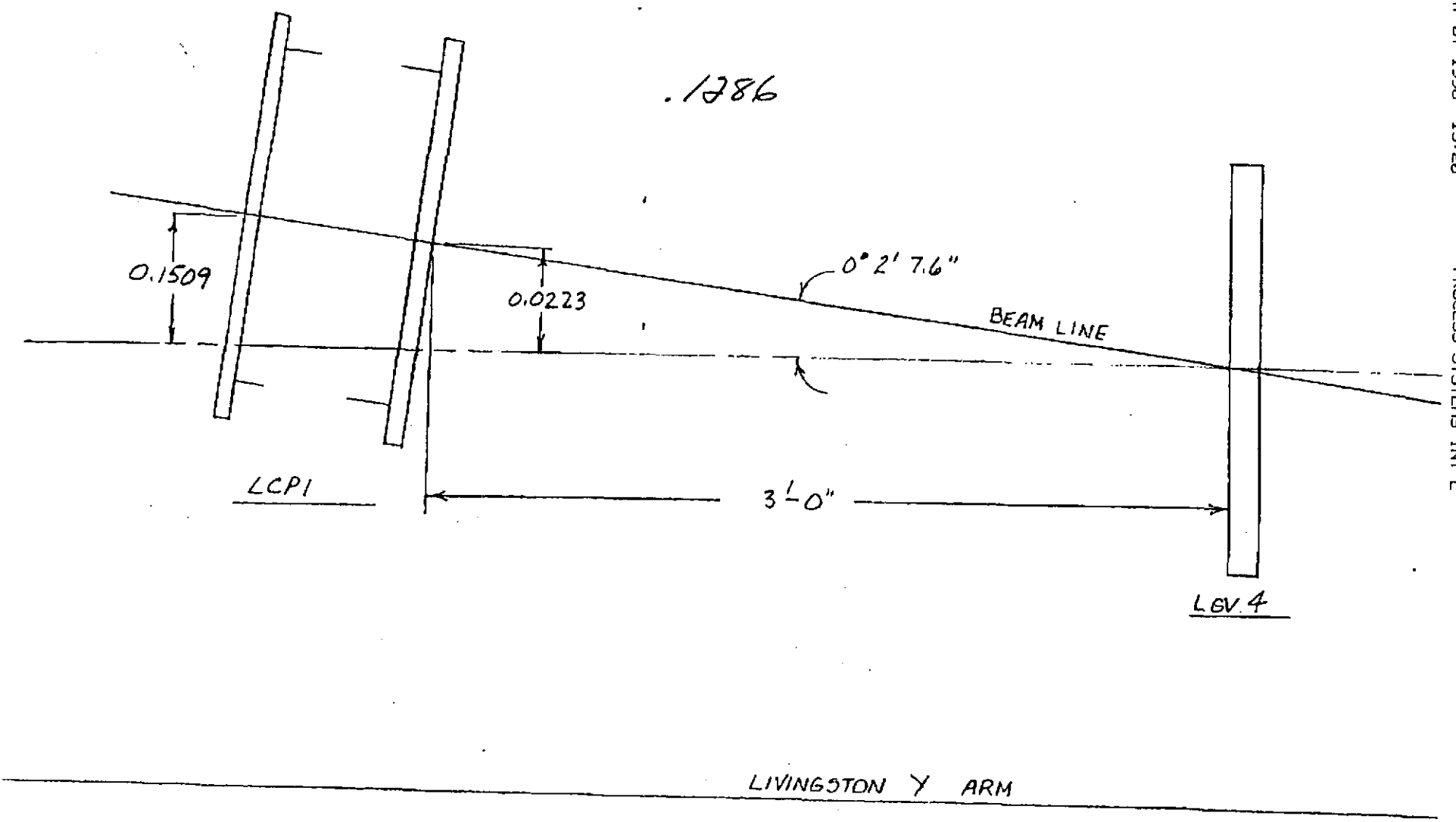
Bolt Torque

By: TDS 8-1-98

Comments:

Rework Required:

1286



TUES.

DATE 7/7/98

CORNER ST

PAGE # 72^o

FINAL SET CP-1

☒ NORTH FLANGE
.012" WEST OF ☒
SOUTH FLANGE
2' 2 ³/₃₂ ± .010"

NORTH FLANGE ELEV.
CALC. .974" BELOW VERTEX
MEAS: .013" HIGH
CALC: TILT .152"
MEAS .165"

ENDO + ¹/₁₆"

SHOT LOCATIONS FOR

LB-9A

LB-E5

LB-1B

DATE

7/1/98 CORNER ST

PAGE #

72°

CP-1 PRE BOLT
DUAL BOBS SOUTH END
2' 2 $\frac{1}{8}$ " \pm .010
NORTH END
.003" WEST OF ϕ

ENDS 20' 4" FROM
VALVE FACE TO NORTH
FLANGE.

$\frac{1}{16}$ " LONG

CLOCKING \pm $\frac{1}{32}$
LEGS PLUMB

DATE

7/2/98 CORNER

PAGE # 22

DRILLED FOR CP-1
BOLTS.

STARTED FINAL SET

7 - (3-4-5)^{OFF NO VALUES}

MON.
DATE 7/6/98 CORNER ST

PAGE # 82

WORKED SETTING CA1
& VALVE STAND.

DRILL & BOLT FOR VALVE
SUPPORT
CLEAN UP BUILDING

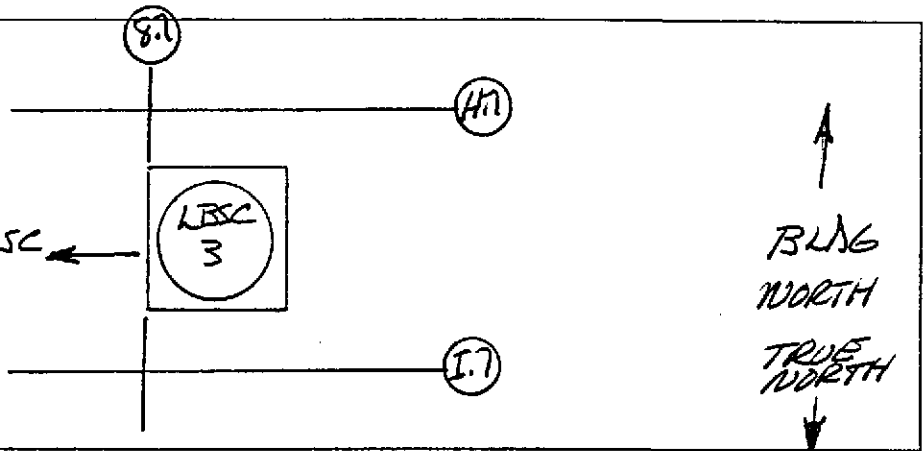
Title: LIGO VACUUM EQUIPMENT COMPONENT ALIGNMENT PROCEDURE

ATTACHMENT B
COMPONENT INSTALLATION DATA SHEET

Component Tag Number LBSC-3
 Component Name BEAM SPLITTER - RIGHT ARM
 Component S/N S/N 13
 Component Installation Weight (lb.) 2000#

Component Installation Position
(Ref. D Build Grid)

MEASUREMENT FROM THE
WEST FACE OF LBSC3 TO
THE EAST FACE OF
LBSC2 66 9/16"

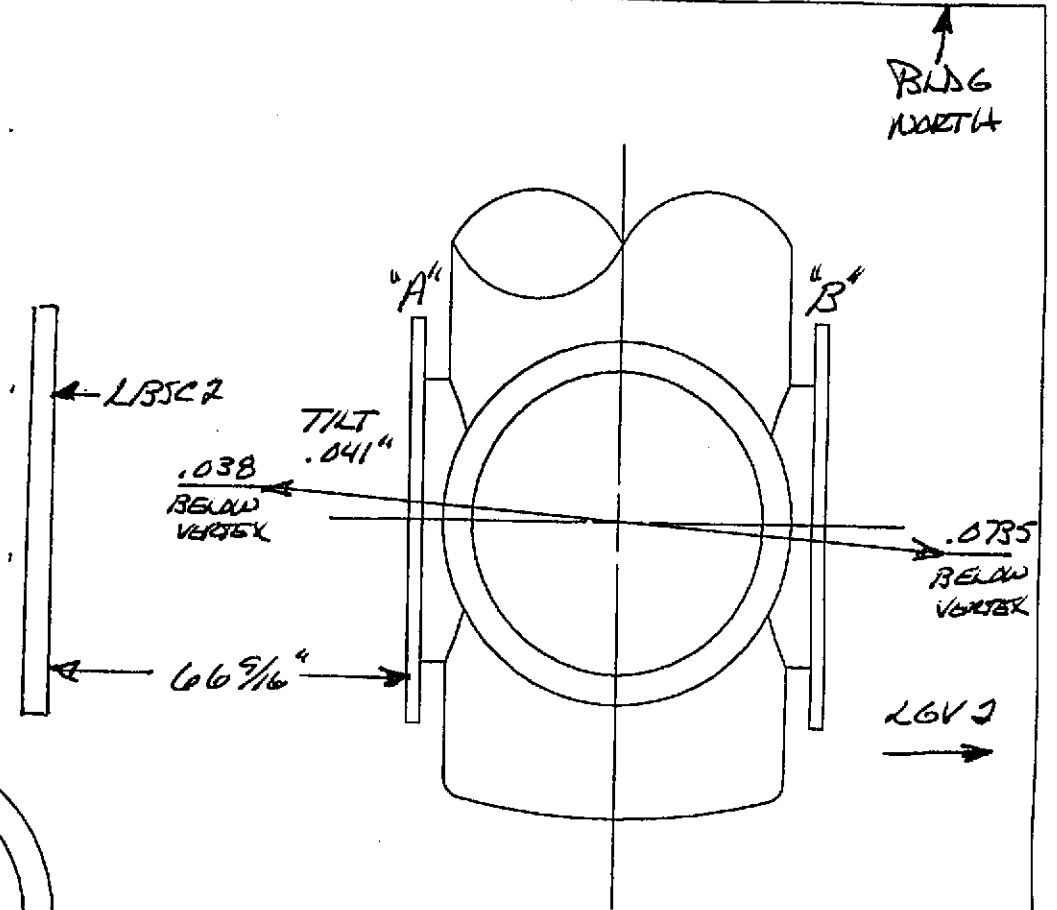
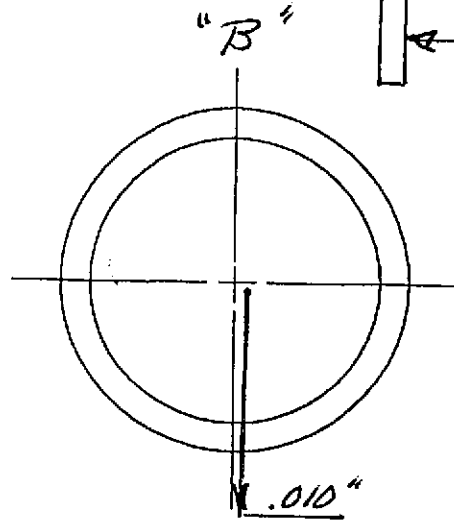
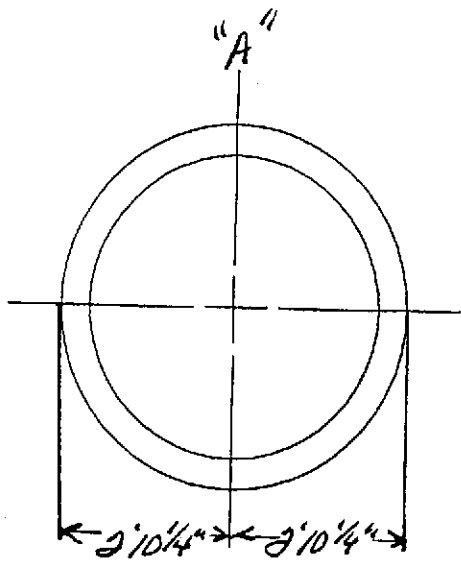


↑
BLDG
NORTH
TRUE
NORTH
↓

Signoffs (Contractor Unless Otherwise Noted)	By	Date
1. Shipping Cover Cross Hairs Verified	TAS	2 JUNE 98
2. Component Located For Anchor Bolt Marking	TAS	2 JUNE 98
	Buyer ME	3 JUNE 98
3. Final Component Location Complete	TAS	3 JUNE 98
	Buyer ME	3 JUNE 98

SPECIFICATION

Number: A V049-2-174 Rev. 2



Component ID: LIBSC 3

Serial No.: 5/10 013

TOTAL TILT .041"
CALC. TILT .0357"

Title: BEAM SPLITTER
INSTALLED POSITION

Job No.: V55049

Project: LIGO Equipment Set

Scale:
None

Dwn By:

Concrete Anchor Installation Report

Project: LIGO Vacuum Equipment Installation & Commissioning		Job No.: V59049	
Drawing: V049-5-003	Rev. 3	Date: 2 JUN 98	
Item Anchored: LBSC-3	No. of Anchors 16	Size: 1"	Type: HAS-STA

Attribute	a. Installer	b. Accepted	c. N/A	d. Date	
Anchor Type (HAS Std or Super)	TAS	N/A		2 JUN 98	
Spacing & Location	TAS	N/A		↓	
Anchor Size & Length 1" x 15"	TAS	N/A			
Hole Size 1 1/8"	TAS	N/A			
Hole & Core Condition (no voids, etc.)	TAS	N/A			
Embedment (minus 0 plus 1/8") 8 1/4"	TAS	N/A			
Angle (90 deg. ± 1 deg.)	TAS	N/A			
Floor Scarified	TAS	N/A			3 JUN 98
Proper Nut Engagement	TAS	N/A			3 JUN 98
Tightening					28 AUG 98

Torque Device Identification: AP-9 350 FT. LBS

Open Items				
Item No.	Description	Corrective Action	Accept	Date

Comments:

Inspection by: <i>N/A</i>	Date: 3 JUN 98
---------------------------	----------------

COMPONENT CLOSE-OUT DATA SHEET

Component Tag Number:

LBSC-3

Component Name:

BEAM SPLITTER - RIGHT ARM

Component S/N:

S/N 13

Vacuum Sealing Surfaces Inspection

By:

TDS

25-JUNE 98

Buyer:

MSE

Cleanliness Inspection

By:

TDS

25 JUNE 98

Buyer:

MSE

O-Rings Installed

By:

TDS

25 JUNE 98

Buyer:

MSE

Bolt Torque

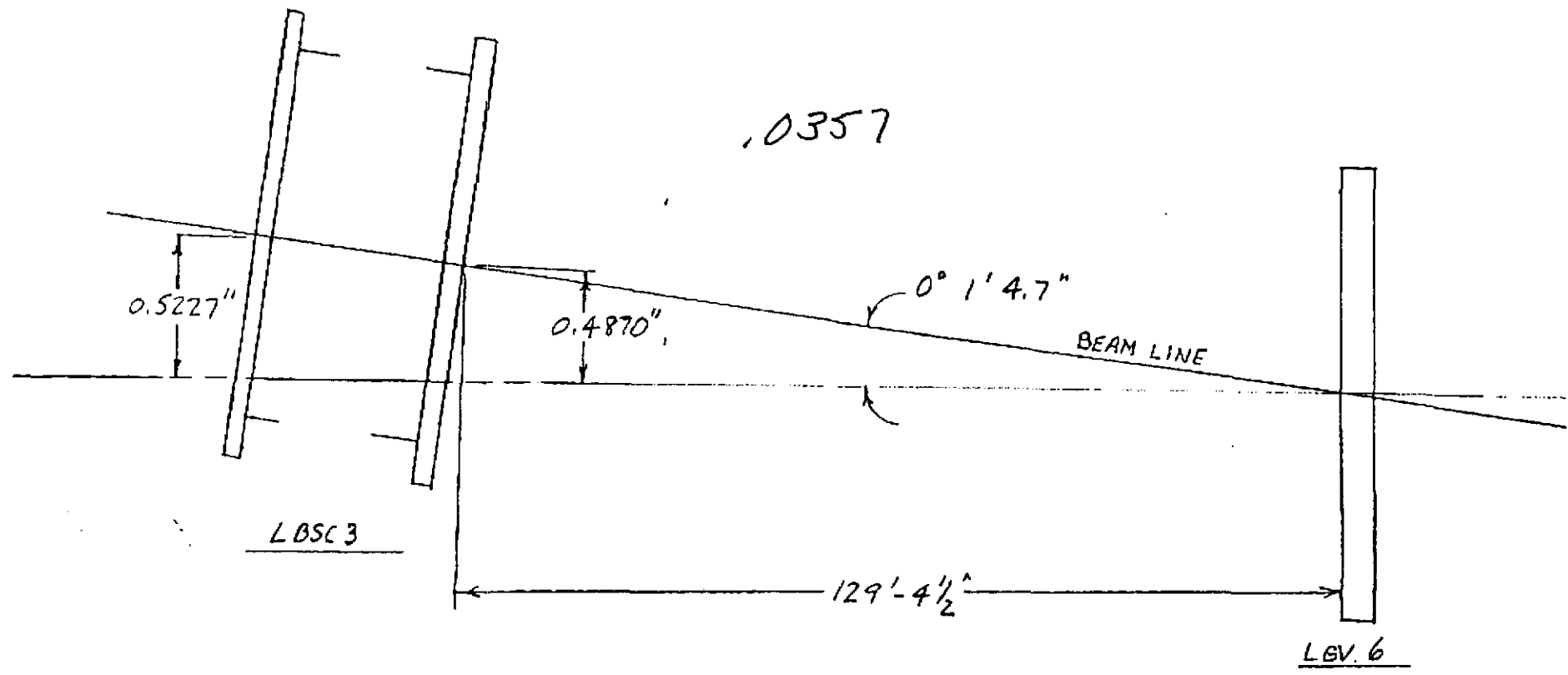
By:

TDS

8-1-98

Comments:

Rework Required:



LIVINGSTON X ARM

Wed.

DATE 6/3/98

CORNER ST

PAGE # 76

BSC-3 FINAL SET
ELEV.

EAST FLANGE
.038" BELOW VERTEX

WEST FLANGE
.071" BELOW VERTEX

WEST FLANGE ϕ
.010 NORTH OF ϕ

EAST FLANGE DUAL BC
2' 2 $\frac{1}{4}$ " \pm .010"

66 $\frac{9}{16}$ " BETWEEN BSC-2 ϕ & :

O.C. DAVE EVERS & ALLEN SIEB.

TUESDAY

A/C OFF

DATE

6/2/98 CORNER ST

PAGE # 84

PRE BOLT SET ON BSC-
WITH DUAL BOBS @
2' 2 1/4". NO TILT SET.
66 9/16" FLANGE FACE TO
FLANGE FACE.



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581
ATTN:

REPORT NO.: 1
DATE: 08/14/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Process Systems
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: Gate Valve 3 Stand

ARCHITECT:
DATE PLACED: 07/15/98
MIX USED: -
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR C-173 C-231	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	N/A	N/A	13:57	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
1A	1	7	07/22/98	27,671	4.00	6,918	N/A
1B	1	14	07/29/98	38,676	4.00	9,669	N/A
1C	1	28	08/12/98	47,190	4.00	11,798	N/A

Samples were received in our laboratory on 07/17/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Michael P. McGowan

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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581

REPORT NO.: 2
DATE: 08/21/98
FILE NO.: DBR-08060
CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER: ARCHITECT:
CONTRACTOR: DATE PLACED: 07/23/98
SUPPLIER: Hilti MIX USED: -
STRENGTH: 7000 P S I @ 28 Days SLUMP RANGE: -
YARDS PLACED: -
LOCATION PLACED: Ham 5 Foundation L B 5 A West Side *CORNER STATION*

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR C-173	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	C-231	C-138	8:30	-
						N/A	N/A		

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
2A	1	7	07/30/98	24,303	4.00	6,076	N/A
2B	1	14	08/06/98	33,225	4.00	8,306	N/A
2C	1	28	08/20/98	32,597	4.00	8,174	N/A
2D	2	7	07/30/98	18,832	4.00	4,708	N/A
2E	2	14	08/06/98	35,638	4.00	8,910	N/A
2F	2	28	08/20/98	28,282	4.00	7,071	N/A

Samples were received in our laboratory on 07/24/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581

REPORT NO.: 3
DATE: 08/21/98
FILE NO.: DBR-08060
CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: -
YARDS PLACED: -
LOCATION PLACED: East Leg Beam Splitter 3 Ham 5 East South L B 5 A
ARCHITECT:
DATE PLACED: 07/24/98
MIX USED: -
SLUMP RANGE: -
CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	C-173 C-231 N/A	C-138 N/A	-	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
3A	1	7	07/31/98	22,435	4.00	5,609	N/A
3B	1	14	08/07/98	23,876	4.00	5,969	N/A
3C	1	28	08/21/98	27,466	4.00	6,867	N/A

Samples were received in our laboratory on 07/27/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Michael P. McGowan

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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581

REPORT NO.: 4
DATE: 08/24/98
FILE NO.: DBR-08060
CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: West Side Of Ham #4

ARCHITECT:
DATE PLACED: 07/27/98
MIX USED: -
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP C-1064	AIR TEMP	SLUMP, INCHES C-143	% AIR C-173 C-231	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	-	-	-	N/A	N/A	8:00	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
4A	1	7	08/03/98	20,371	4.00	5,093	N/A
4B	1	14	08/10/98	27,318	4.00	6,830	N/A
4C	1	28	08/24/98	37,347	4.00	9,337	N/A

Samples were received in our laboratory on 07/28/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Michael P. McGowan

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Michael P. McGowan, Vice President

ok

Westborough, Ma. 01581

FILE NO.: OBR-UH060
CLIENT NO.:

ATTN:

REPORT #5

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L & G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED:
LOCATION PLACED: North Side Ham #2

ARCHITECT:
DATE PLACED: 07/28/98
MIX USED: -
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
1			C-1064		C-143	C 231	C-138	7:35	
						N/A	N/A		

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
5A	1	7	08/04/98	18,196	4.00	4,549	N/A
5B	1	14	08/11/98	23,499	4.00	5,875	N/A
5C	1	28	08/25/98	36,230	4.00	9,058	N/A

Samples were received in our laboratory on 07/29/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581

REPORT NO.: 6
DATE: 08/26/98
FILE NO.: DBR-08060
CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: North Side Ham #3

ARCHITECT:
DATE PLACED: 07/29/98
MIX USED: C G 200 Pc
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	C-231	C-138	-	-
						N/A	N/A		

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
6A	1	7	08/05/98	13,621	4.00	3,405	N/A
6B	1	14	08/12/98	18,849	4.00	4,712	N/A
6C	1	28	08/26/98	33,592	4.00	8,398	N/A

Samples were received in our laboratory on 07/30/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Copies Sent To:

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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581
ATTN: .

REPORT NO.: 7
DATE: 09/01/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER: ARCHITECT:
CONTRACTOR: DATE PLACED: 07/30/98
SUPPLIER: Hilti MIX USED: C E 200 P C
STRENGTH: 7000 P S I @ 28 Days SLUMP RANGE: -
YARDS PLACED: -
LOCATION PLACED: Arma End Station Beam Splitter #4

*RIGHT END STATION
ALL EQUIPMENT*

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL NO	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR C-173	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	C-231	C-138	8:10	-
						N/A	N/A		

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
7A	1	7	08/06/98	21,010	4.00	5,253	N/A
7B	1	14	08/13/98	36,769	4.00	9,192	N/A
7C	1	28	08/27/98	43,792	4.00	10,948	N/A

Samples were received in our laboratory on 07/31/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581
ATTN:

REPORT NO.: 8
DATE: 08/31/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: East Side Ham #6

ARCHITECT:
DATE PLACED: 07/31/98
MIX USED: C G 200 P C
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET	TRUCK	TICKET	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR C-173	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
0	NO	NO	C-1064		C-143	C-231	C-138		
1	-	-	-	-	-	N/A	N/A	-	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
8A	1	7	08/07/98	21,066	4.00	5,267	N/A
8B	1	14	08/14/98	23,622	4.00	5,906	N/A
8C	1	28	08/28/98	31,622	4.00	7,906	N/A

Samples were received in our laboratory on 08/03/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Copies Sent To:

Michael P. McGowan
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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH:

20 Walkup Drive
Westborough, Ma. 01581

ATTN:

REPORT NO.: 9
DATE: 09/01/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: -
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: Beams Splitter #5

ARCHITECT:
DATE PLACED: 08/03/98
MIX USED: C G 200 P C
SLUMP RANGE: -

LEFT END STATION - ALL EQUIPMENT

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL	TRUCK	TICKET	CONC	AIR	SLUMP,	% AIR	UNIT WT	TIME	YARDS
NO	NO	NO	TEMP	TEMP	INCHES	C-173	LBS/CF	SAMPLED	WHEN
			C-1064		C-143	C-231	C-138		SAMPLED
1	-	-	-	-	-	N/A	N/A	-	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
9A	1	7	08/10/98	27,369	4.00	6,842	N/A
9B	1	14	08/17/98	29,601	4.00	7,400	N/A
9C	1	28	08/31/98	35,499	4.00	8,875	N/A

Samples were received in our laboratory on 08/04/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Michael P. McGowan

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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581
ATTN:

REPORT NO.: 10
DATE: 09/01/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: Ham #1

ARCHITECT:
DATE PLACED: 08/04/98
MIX USED: C B 200 P C
SLUMP RANGE: -

Corner Station

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL	TRUCK	TICKET	CONC	AIR	SLUMP,	% AIR	UNIT WT	TIME	YARDS
NO	NO	NO	TEMP	TEMP	INCHES	C-173	LBS/CF	SAMPLED	WHEN
1	-	-	C-1064	81	C-143	C-231	C-138	8:05	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
10A	1	7	08/11/98	16,235	4.00	4,059	N/A
10B	1	14	08/18/98	22,436	4.00	5,609	N/A
10C	1	28	09/01/98	28,461	4.00	7,115	N/A

Samples were received in our laboratory on 08/05/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Copies Sent To:

Michael P. McGowan
DELTA TESTING AND INSPECTION, INC.
Michael P. McGowan, Vice President



DELTA TESTING AND INSPECTION, INC.

1855 MASON AVE. • BATON ROUGE, LA 70805 • PHONE 504-356-4355 • FAX 504-356-0519

REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
THROUGH: 20 Walkup Drive
Westborough, Ma. 01581

REPORT NO.: 11
DATE: 09/04/98
FILE NO.: DBR-08060
CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER: ARCHITECT:
CONTRACTOR: DATE PLACED: 08/05/98
SUPPLIER: Hilti MIX USED: C G 200 P C
STRENGTH: 7000 P S I @ 28 Days SLUMP RANGE: -
YARDS PLACED: -
LOCATION PLACED: Supports On Spool Piece L B 9 B, B E 6

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET	TRUCK NO	TICKET NO	CONC TEMP	AIR TEMP	SLUMP, INCHES	% AIR	UNIT WT LBS/CF	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	C-1064	-	C-143	C-231	C-138	-	-
						N/A	N/A		

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
11A	1	7	08/12/98	29,179	4.00	7,295	N/A
11B	1	14	08/19/98	31,226	4.00	7,807	N/A
11C	1	28	09/02/98	36,673	4.00	9,168	N/A

Samples were received in our laboratory on 08/06/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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REPORT OF TESTS OF 2" X 2" CUBES

CLIENT: Process Systems Inter.
THROUGH:
20 Walkup Drive
Westborough, Ma. 01581
ATTN:

REPORT NO.: 12
DATE: 09/03/98
FILE NO.: DBR-08060
CLIENT NO.:

TYPE OF SERVICE: Jobsite Monitoring
PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
CONTRACTOR:
SUPPLIER: Hilti
STRENGTH: 7000 P S I @ 28 Days
YARDS PLACED: -
LOCATION PLACED: Cp2, Lp9a, Be5

ARCHITECT:
DATE PLACED: 08/06/98
MIX USED: Cg200 Pc
SLUMP RANGE: -

CORNER STATION

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP C-1064	AIR TEMP	SLUMP, INCHES C-143	% AIR C-173 C-231	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	-	-	-	N/A	N/A	7:50	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
12A	1	7	08/13/98	34,582	4.00	8,646	N/A
12B	1	14	08/20/98	17,256	4.00	4,317	N/A
12C	1	28	09/03/98	31,461	4.00	7,865	N/A

Samples were received in our laboratory on 08/07/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

Michael P. McGowan

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Michael P. McGowan, Vice President



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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
 THROUGH: 20 Walkup Drive
 Westborough, Ma. 01581

REPORT NO.: 13
 DATE: 09/14/98
 FILE NO.: DBR-08060
 CLIENT NO.:

ATTN:

TYPE OF SERVICE: Jobsite Monitoring
 PROJECT: L I C O Project

PROJECT INFORMATION

ENGINEER:
 CONTRACTOR:
 SUPPLIER: -
 STRENGTH: -
 YARDS PLACED: -
 LOCATION PLACED: Tubing Support #3 Beam Splitter 1-valve Support Stand,
 North & South

ARCHITECT:
 DATE PLACED: 08/17/98
 MIX USED: -
 SLUMP RANGE: -

CORNER STATION
TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: W Kelly

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP C-1064	AIR TEMP	SLUMP, INCHES C-143	% AIR C-173 C-231	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	-	-	-	N/A	N/A	-	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
13A	1	7	08/24/98	17,054	4.00	4,264	N/A
13B	1	14	08/31/98	18,930	4.00	4,733	N/A
13C	1	28	09/14/98	29,008	4.00	7,252	N/A

Samples were received in our laboratory on 08/18/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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REPORT OF TESTS OF 2" CUBES

CLIENT: Process Systems Inter.
 THROUGH: 20 Walkup Drive
 Westborough, Ma. 01581

REPORT NO.: 14
 DATE: 09/15/98
 FILE NO.: DBR-08060
 CLIENT NO.:

ATTN:

TYPE OF SERVICE: Testing Of Submitted Samples
 PROJECT: L I G O Project

PROJECT INFORMATION

ENGINEER:
 CONTRACTOR:
 SUPPLIER: -
 STRENGTH: -
 YARDS PLACED: -
 LOCATION PLACED: -

ARCHITECT:
 DATE PLACED: 08/18/98
 MIX USED: -
 SLUMP RANGE: -

LAGV2
LA7A *CORNER STATION*

TEST INFORMATION

FIELD TEST INFORMATION

Tests Performed By Technician: Submitted

CYL SET NO	TRUCK NO	TICKET NO	CONC TEMP C-1064	AIR TEMP	SLUMP, INCHES C-143	% AIR C-173 C-231	UNIT WT LBS/CF C-138	TIME SAMPLED	YARDS WHEN SAMPLED
1	-	-	-	-	-	N/A	N/A	-	-

LABORATORY TEST INFORMATION

SAMPLE MARK	SET NO.	AGE, DAYS	DATE TESTED	LOAD, POUNDS	AREA, SQ. IN.	STRENGTH PSI	TYPE BREAK
14A	1	7	08/25/98	22,091	4.00	5,523	N/A
14B	1	14	09/01/98	25,585	4.00	6,396	N/A
14C	1	28	09/15/98	29,654	4.00	7,414	N/A

Samples were received in our laboratory on 08/19/98. Samples were cured and tested in accordance with ASTM Standards for the materials tested.

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