Mark IV Memo #144.3
VLBA ACQ Memo #352.1

Stepped and Triple-Cap Headstack Specification for VLBI Tape Recorders

March 3, 2000

Revision 1.3

User Institutions

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This document combines the three previous documents specifying the construction of the VLBI head-stacks written by MIT Haystack Observatory, NRAO and JPL. The original document was written by the Haystack Observatory to describe a set of rules to manufacture the Mk3A/VLBA stepped head-stacks [1]. This document has recently been updated by NRAO [2] based on the changes that occurred in thin tape and VLBA recording. Specs for the manufacturing of the triple-cap head-stacks was written by JPL [3] based on the new general specs given by NRAO [2] and a Haystack-drawing [4]. The current specification is written based on consensus of the institutions mentioned above and the two manufacturers Metrum-Datatape, Inc. and Spin Physics, Inc.

DRAWINGS:

Figure 1: VLBA drawing number C54330M030 Rev-D : Stepped headstack.
Figure 2: Haystack drawing number 54330K001 Rev-D : Triplecap contour.
Figure 3: Haystack drawing number 6310-117 Rev-A : AMP connector
Figure 4: Haystack drawing number 6311-24-Rev-D : Contour inspection block.
Figure 5: Haystack drawing number 54330K003-Rev-A : Triple cap contour (square slot)

INSPECTION SHEETS:

1) Optical inspection sheets of the head profiles:

a) for the stepped headstack (two required for complete inspection at the heads 2 and 33),
b) for the triple cap headstack (two required for complete inspection at the heads 2 and 33),

2) Head edge location measurement sheet for compliance with Spec 1.4,
3) Initial depth of gap measurement sheet.
4) Electrical performance documentation sheet.

SPECIFICATIONS:

1. MECHANICAL:

1.1 HEADS PER STACK: 36

1.2 HEAD PITCH: 0.0275” (0.6985 mm)

1.3 HEAD WIDTH: 0 .0015” (0.0381mm)

1.4 HEAD EDGE LOCATION TOLERANCE: +/- 0.00012” (3 μm) worst case out of 72 with respect to best fit ideal pattern at 23^{o} C.

1.5 HEAD NUMBERING CONVENTION: When viewed from the side opposite the normal mounting side with the tape-bearing surface up, the head numbers increase from right to left, from #0 to #35. The odd-numbered heads are wired to the connector closer to this (non-mounting) side. In this view the high mounting hole is on the left.

1.6 OVERALL DIMENSIONS: LxWxH = 1.560” x 0.300” x 0.400” each +/- 0.005".

1.7.a GAPLINE AND MOUNTING SURFACE PARALLELISM: 0.0005" (end-to-end of tip plate, approximately 1.13" long).

1.7.b GAPLINE-TO-MOUNTING-SURFACE DISTANCE: 0.150" +/- 0.005".

Note-1: The parallelism requirement supercedes the distance requirement, and both must be met.

Note-2: The parallelism requirement is equivalent to keeping the absolute value of the difference of gapline-to-mounting surface distances at head #2 and head#33 less than or equal to 10 μm as indicated in the optical inspection sheets.

1.7.c Same as 1.7.a and 1.7.b applied to the alternate mounting surface opposite 'normal'.

1.8 CONTOUR ROTATION ANGLE: 5.0^{o} +/- 0.2^{o}, counterclockwise when viewed from end closest to head #35. The internal angle between mounting surface –on the left if the tape-bearing surface (step) is up- and the plane in which both step edges lie, is nominally 95 degrees. The headstack carrier has no wrap angle adjustment. The gap plane may be parallel to the mounting surface or (as in the original design) normal to the plan tangent to the contour at the gapline.

1.8.a Internal angle between plane of both step edges and alternate mounting surface is 85^{o} +/- 0.2^{o}.

1.9 MOUNTING HOLES: The high (left in Figure 1) hole is 0.180" and the low (right in Figure 1) hole 0.320" below the step (top of headstack). Thru-hole diameter is 0.079/0.081" and the 0.125" counterbore is 0.075" deep. The holes are 0.080" from the ends and spacing is 1.400". Unless otherwise noted all hole location and depth tolerances are +/- 0.005". The headstack is mounted with, 0.3", 0-80 screws, and at most two washers (0.110" OD x 0.066" ID x 0.016" thick) using an alignment jig.

1.10 END TRIM: 0.299" +/- 0.005" from either end to center of nearest head, #0 and #35 respectively.

1.11 GAP APEX-LINE STRAIGHTNESS: 0.0001" (2.5 μm) maximum bow in depth-of-gap direction.

Note: Process conformance can be checked by flat lapping a worn-out head.

1.12 CONNECTORS: pair of 40-pin AMP#1-203990-7 connectors, or compatible equivalent, mounted flush with bottom of head stack, centered with 0.105" +/- 0.010" spacing between centerlines of internal rows of connector pins. Must not project at all, nor be recessed more than 0.010", from the bottom of the head stack. Must be securely fastened; epoxy must not wick into sockets. Odd or even head wires in order, with consistent polarity, to the central 36 sockets of each connector. See Figures 1 and 3 for more information.

1.13 INITIAL DEPTH OF GAP: 0.0010" minimum. Both tip-plate ends must be optically observable in cross-section (end-view) to permit inspection for initial depth of gap. End-to-end difference in initial depth of gap is not to exceed 0.0001". Larger depth of gap desired to increase head life. If focus height measurements are needed to correct for wear and end "roll-off" then see the Inspection Sheet #3.

1.14 GAP LENGTH: 11.8-17 μin (300-430 nm)

Note: The definitive test for conformance is measurement of gap null wavelength.

2. HEAD PROFILE:

For symmetry, assume measurements with stack mounted on 5^o surface of inspection block. See Figure 4.

2.1 CONTOUR ROTATION ANGLE 5.0^o +/- 0.2^o, CCW viewed from end closest to head # 35.

2.2 GAPLINE-TO-STEP-EDGE DISTANCE: 0.0059" +/- 0.0002" (150 +/- 5 μm) end-to-end.

2.3 OFF-STEP PROFILE: Must be designed and toleranced so that when the head is worn to the gap apex, no part of the off-step contour is closer to the tape than 0.0020". Assume the tape leaves the last tape bearing edge at 5^o. This requirement must be met by any profile beyond the first and last tape bearing edge.

2.4 TAPE-BEARING SURFACE DESCRIPTION: The contour height with respect to step edges, as manufactured, shall be 2 μm (typical) for the triple-cap head and 3.5 μm (typical) for the stepped head. See the Inspection Sheets 1.a,b for more details.

Note: For the triple cap head, 1.8 μm height corresponds to 6.3 mm radius, and for the stepped head 3.4 μm height corresponds to 3.3 mm radius.

2.5 ERROR IN TAPE-BEARING SURFACE ORIENTATION ANGLE: +/- 0.20^o max, (For example, 1 μm max difference in focal height between the step edges for a 300 μm wide step, or 3μm maximum between outer edges of outriggers). See inspection sheet.

2.6 DISTANCE BETWEEN CROSS TAPE DIRECTION CONTOUR-ENDS AND HEAD-PATTERN-CENTER: 0.560" minimum. Initial machine contouring extends to the ends of the gap bar (tip plate).

2.7 TAPE-BEARING SURFACE QUALITY: Epoxy glue lines not to exceed 0.0008" width; bubbles in glass or epoxy not to exceed 0.0003".

3. ELECTRICAL PERFORMANCE:

3.1 INDUCTANCE (for reference only): 15/25 μH, measured at 250 kHz. Original design uses 48 turns of #50 wire.

3.2 RESISTANCE (for reference only): Less than 5 ohms.

3.3 READ PERFORMANCE SPECIFICATION: Greater than or equal to 20 dB signal to noise, when measured as follows:

A. Reading a VLBI formatted test tape, optimally recorded[1], undegraded[2], standard low-pass filtered[3], one bit sampled, random noise signal recorded at 2.21 fc/μm (56250 fc/in),

B. on a SONY D1K tape, supplied by Haystack or NRAO,

C. at a speed of 4.064 m/s (160 ips), bi-directionally (report both directions, difference not to exceed 1 dB),

D. in a 30 kHz resolution bandwidth centered at 4.4 MHz,

E. noise level measured with tape stopped,

F. using VLBA head-interface/preamps, spectrum analyzer, and scope for eye-pattern check,

G. at a nominal tension of 10" water vacuum in a Metrum 96 tape drive.

4. MATERIALS (for reference only):

4.1 HEAD TIPS: single-crystal MnZn-ferrite [Hitachi HS-3] or equivalent; oriented (211) tape bearing plane, (110) cross-section plane (end of gapped bar), (111) side of gapped bar (parallel to gap plane).

4.2 SPACERS: Calcium Titanate (3M851D) or Corning Fotoceram or equivalent.

5. APPLICATION (for reference only):

Write and read 1”-wide 900 Oe D1/SVHS-equivalent tapes at 2.21 fc/μm.

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[1] Recorded with the lowest current that maximizes the short wavelength 0.9 μm (4.4 MHz at 160 ips) response.
[2] A reference head used only for this purpose measures degradation. Upto 2dB degradation is acceptable for purposes of measuring read performance. Correction for such degradation accompanied with proper documentation is allowed.
[3] The recorded white-noise video signal is low-pass filtered with a standard VLBA filter. See Rogers, A.E.E., (1985) "Suggested VLBA Bandpass", VLBA Acq. Memo. 48, August 7.

6. **COMPATIBILITY** (for reference only):

6.1 MECHANICAL: Physically compatible with headstack mount/positioner designed by Haystack Observatory – design is in public domain – for MkIIIA, VLBA, and MkIV VLBI recording systems. This dual mount/positioner is mechanically fitted to a Metrum 96 drive.

6.2 ELECTRONIC: The connectors, including geometry of placement, are compatible with MkIIIA write-only and read-only interfaces as well as VLBA/MkIV read-or-write interfaces.

APPENDIX A: Changes And Modifications to the Specifications

The following change(s) have been made to the specification.

1. Version 1.2: (August 17, 1998)

    - Figure 1 VLBA Drawing No.: Stepped Headstack C54330M030
      Rev. C became Rev. D.
      Gapline to mounting surface distance 150±0.005μm on each side of the gapline.

    - Inspection Sheet 1.6: VLBI Triple Cap Contour Inspection Sheet 1.b.
      Rev.C became Rev.D.
      GMS in dimension x7 and x8[1] have been changed.

2. Version 1.3 (Mar 2, 2000)

    - Drawing #54330K003. Rev. A added to show square slot Triple Cap Contour (Figure 5)
    - Add text describing square slot Tripe-Cap Headstack

Square Slot Triple-Cap Headstack for VLBI Tape Recorders

The advantages of the square slot triple cap instead of the 9 degree bevel slot are in the ability to hold dimensional control of the face geometry. Controlling the intersection line of 2 shallow angles of 3.5 degree and 9 degree over the full compound angle length is very difficult. It also requires a separate setup for each side. Since this operation is done near the finish of the head construction it is very expensive to scrap a head at this point. The square slot is easier to set up and the concentration can be on the slot edge instead of edge and depth. Also, the square slot eliminates special wheel dressing and allows wider choice of blades. Another advantage is that the slot will have more definition over the life of the head.

Metrum has discontinued the angled slot version of the Triple-Cap Headstack. Spin Physics sells both the angled slot Triple-Cap, part #204893, and the square slot Triple-cap, part #204919.

References:

1) Hinteregger, H.F, Headstack Specification For Mk3A/VLBA/Mk4 Compatibility, MIT-Haystack Observatory, Mark IV Memo 144, VLBA Acquisition Memo 352, March 1993.

2) Anonymous, VLBA Headstack Specification, Specification number A54330N001, NRAO, 16 May 1997.

3) Anonymous, MARK IV Triple Cap Headstack Specification, JPL, California Institute of Technology, Pasadena CA, 5 June 1997.

4) Hinteregger, H.F., Triple Cap (Experimental) Modification I Engineering Drawing No: 54330K001, 13 July 1994.

MFR:_____

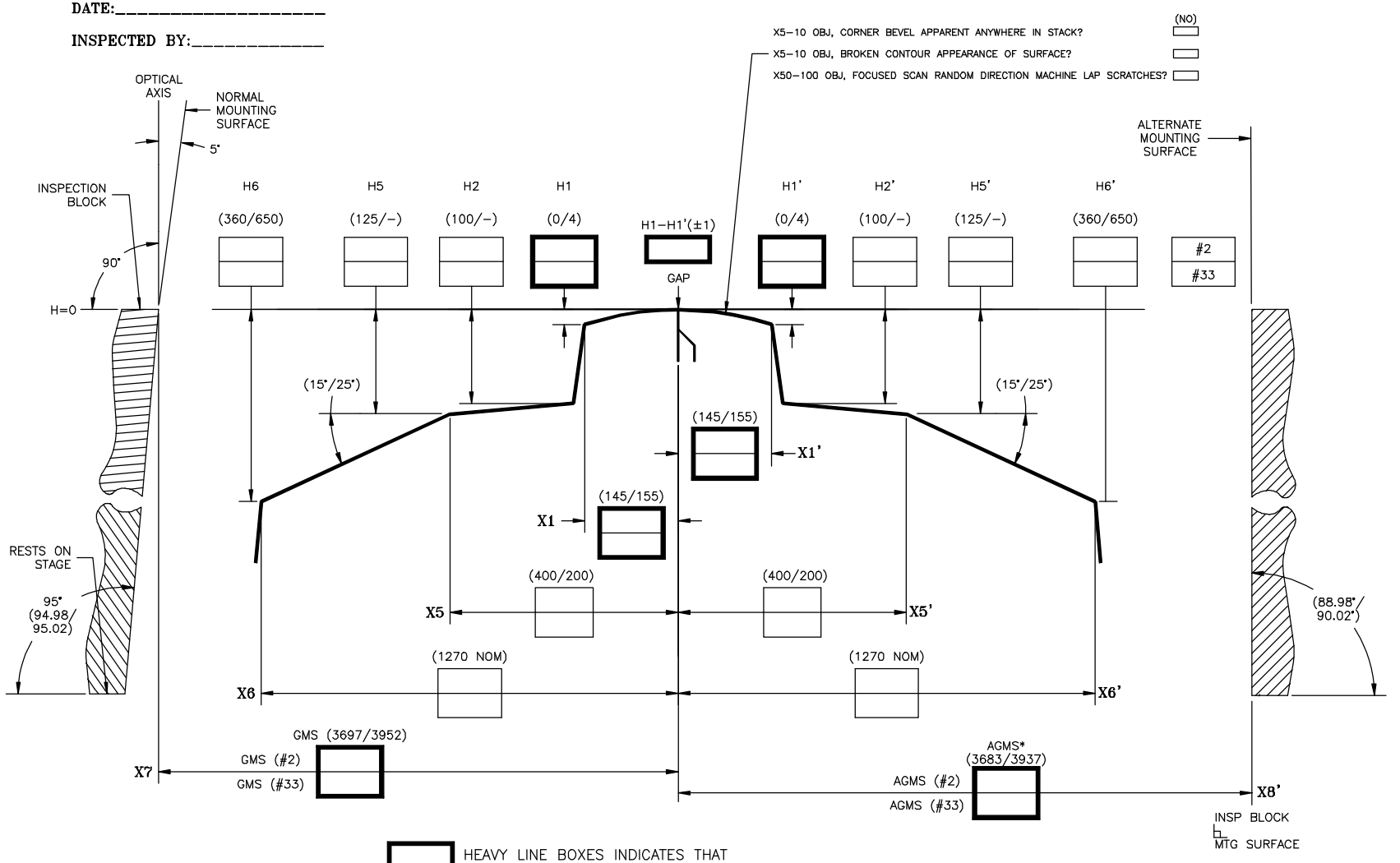
P/N:_____

SER#:_____

DATE:_____

INSPECTED BY:_____

Figure 1



MEASUREMENTS ARE IN MICRONS, TAKEN AT: CHANNEL # 2, NEAR LOW C'BORE HOLE, FAR END IN THIS VIEW, AND CHANNEL #33, NEAR HIGH HOLE END

*JIVE REQUIREMENT, ONLY AGMS MEASUREMENTS USE MTG SURFACE OF INSP BLOCK AND ALT MTG SURFACE OF HEADSTACK

VLBI STEPPED CONTOUR INSPECTION SHEET #1a

H. HINTEREGGER 04/05/99

CAD FILE: INSPECTS.DWG REV D

Figure 2

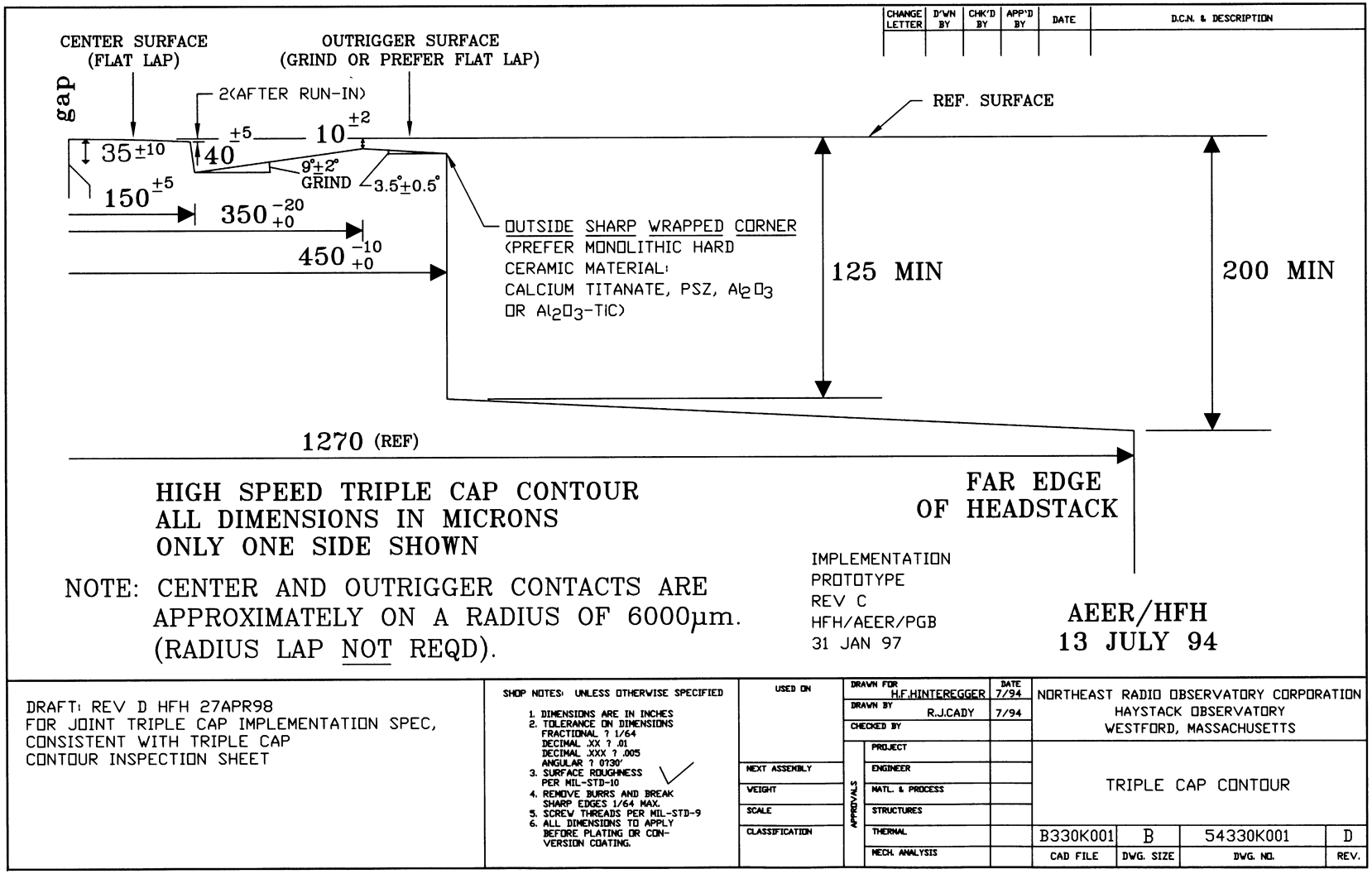
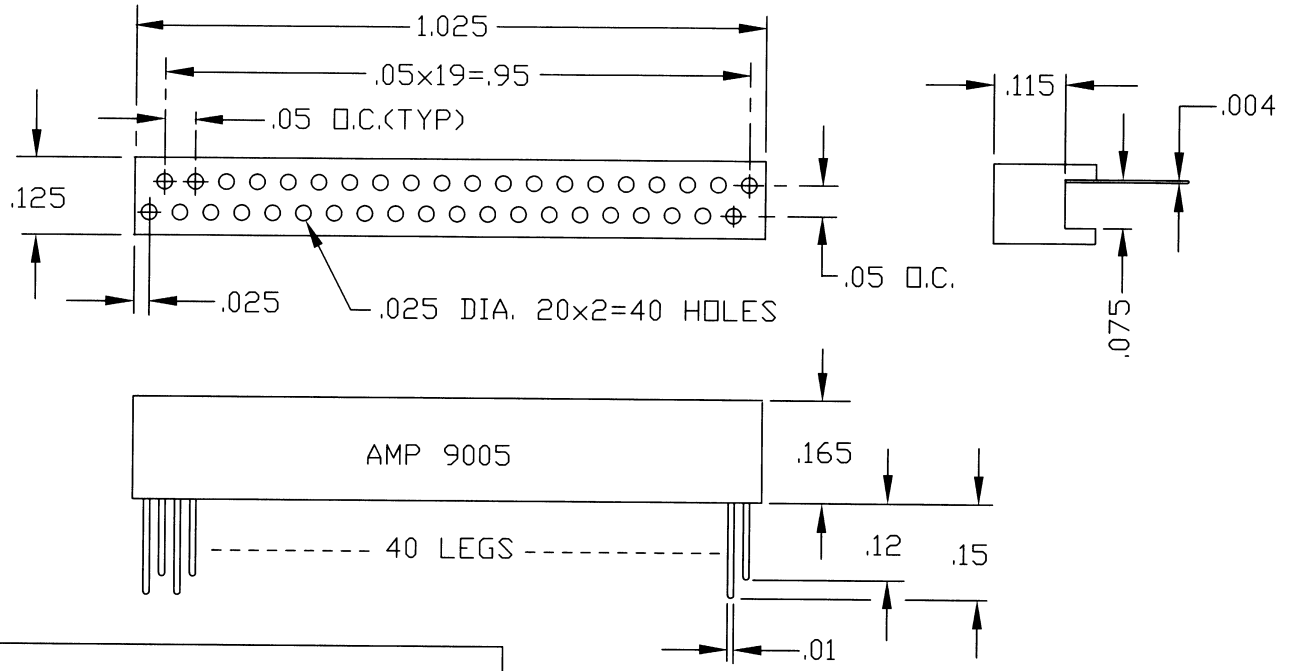

CHANGE LETTER | D'WN BY | CHK'D BY | APP'D BY | DATE | D.C.N. & DESCRIPTION
CENTER SURFACE (FLAT LAP)
OUTRIGGER SURFACE (GRIND OR PREFER FLAT LAP)
gap
2(AFTER RUN-IN)
REF. SURFACE
35 ±10
±5
40
10 ±2
9°±2°
GRIND
3.5°±0.5°
150 ±5
350 −20 +0
450 −10 +0
OUTSIDE SHARP WRAPPED CORNER
(PREFER MONOLITHIC HARD CERAMIC MATERIAL: CALCIUM TITANATE, PSZ, Al2O3 OR Al2O3-TIC)
125 MIN
200 MIN
1270 (REF)
HIGH SPEED TRIPLE CAP CONTOUR
ALL DIMENSIONS IN MICRONS
ONLY ONE SIDE SHOWN
NOTE: CENTER AND OUTRIGGER CONTACTS ARE APPROXIMATELY ON A RADIUS OF 6000µm. (RADIUS LAP NOT REQD).
FAR EDGE OF HEADSTACK
IMPLEMENTATION PROTOTYPE REV C HFH/AEER/PGB 31 JAN 97
AEER/HFH 13 JULY 94
DRAFT: REV D HFH 27APR98
FOR JOINT TRIPLE CAP IMPLEMENTATION SPEC, CONSISTENT WITH TRIPLE CAP CONTOUR INSPECTION SHEET
SHOP NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS ARE IN INCHES
2. TOLERANCE ON DIMENSIONS FRACTIONAL ? 1/64 DECIMAL .XX ? .01 DECIMAL .XXX ? .005 ANGULAR ? 0730'
3. SURFACE ROUGHNESS PER MIL-STD-10
4. REMOVE BURRS AND BREAK SHARP EDGES 1/64 MAX.
5. SCREW THREADS PER MIL-STD-9
6. ALL DIMENSIONS TO APPLY BEFORE PLATING OR CONVERSION COATING.
USED ON
NEXT ASSEMBLY
WEIGHT
SCALE
CLASSIFICATION
APPROVALS
DRAWN FOR H.F.HINTEREGGER 7/94
DRAWN BY R.J.CADY 7/94
CHECKED BY
PROJECT
ENGINEER
MATL. & PROCESS
STRUCTURES
THERMAL
MECH. ANALYSIS
NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS
TRIPLE CAP CONTOUR
B330K001 | B | 54330K001 | D
CAD FILE | DWG. SIZE | DWG. NO. | REV.

Figure 3

CHANGE LETTER	D'WN BY	CHK'D BY	APP'D BY	DATE	D.C.N. & DESCRIPTION
A	RF			7/20/98	DWG # IN NOTE 1 WAS C-6310-116



NOTES:

1. SEE VLBA DWG. C54330M030 FOR COMPATIBLE HEADSTACK SPECIFICATIONS.

*MANUFACTURER: AMP P/N: 1-203990-7

SHOP NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE IN INCHES
2. TOLERANCE ON DIMENSIONS
   FRACTIONAL ? 1/64
   DECIMAL .XX ? .01
   DECIMAL .XXX ? .005
   ANGULAR ? 0?30'
3. SURFACE ROUGHNESS PER MIL-STD-10
4. REMOVE BURRS AND BREAK SHARP EDGES 1/64 MAX.
5. SCREW THREADS PER MIL-STD-9
6. ALL DIMENSIONS TO APPLY BEFORE PLATING OR CONVERSION COATING.

USED ON

NEXT ASSEMBLY

WEIGHT

SCALE 4x

CLASSIFICATION

APPROVALS		
	PROJECT	
	ENGINEER	
	MATL. & PROCESS	
	STRUCTURES	
	THERMAL	
	MECH. ANALYSIS	

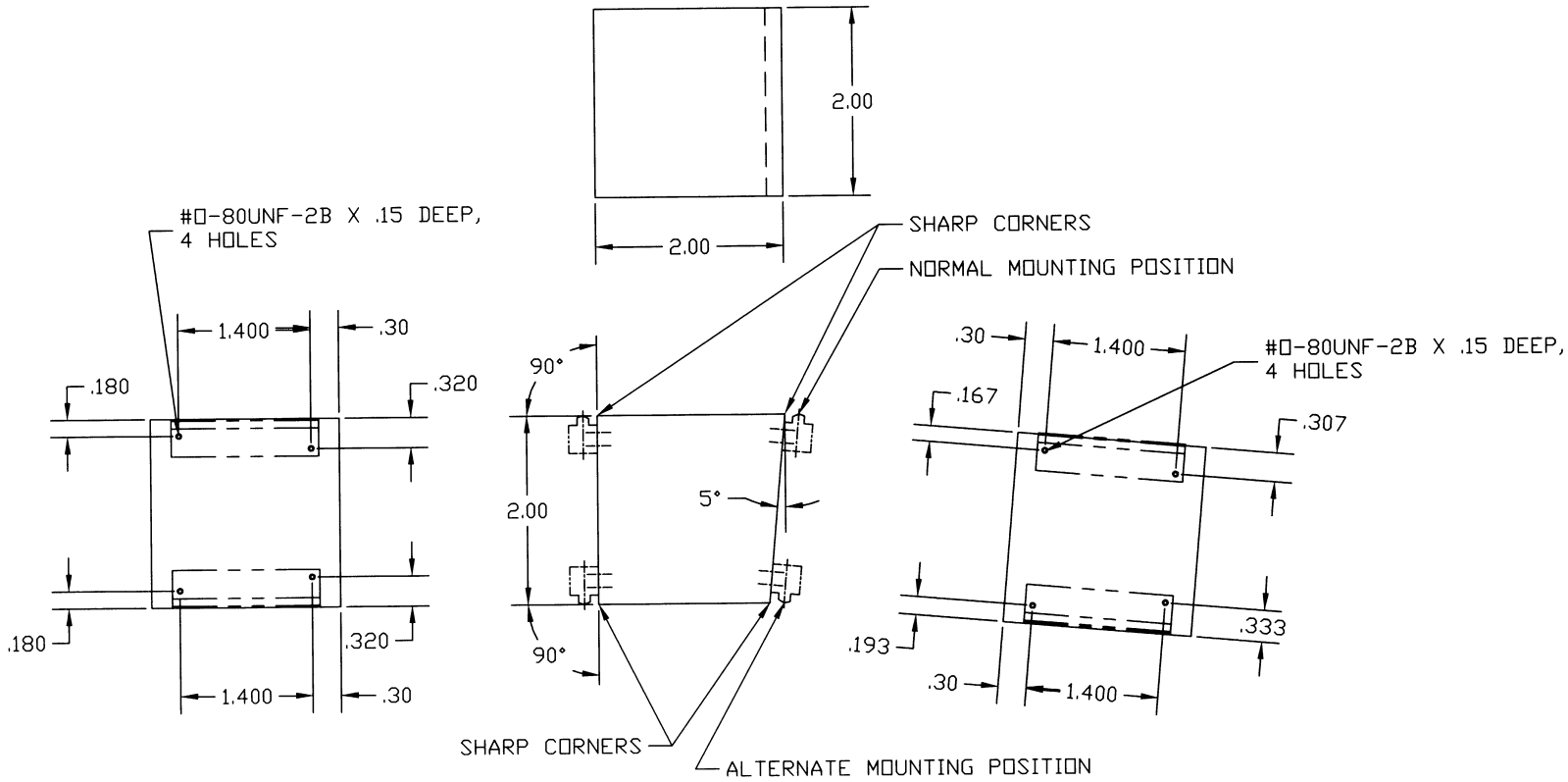
		DATE
DRAWN FOR	H.F.HINTEREGGER	2/93
DRAWN BY	R.J.CADY	2/93
CHECKED BY		

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS

MKIIIA / VLBA / MKIV
AMP CONNECTOR, OUTLINE DIMENSIONS
COMPATIBLE HEADSTACK

A6310117	A	6310-117	A
FILE NAME	DWG. SIZE	DWG. NO.	REV.

Figure 4



TOL:
.XXX ± .005
.XX ± .01
ANG ± .02°

63

MATL: PRECISION PARALLEL GROUND FLAT STEEL

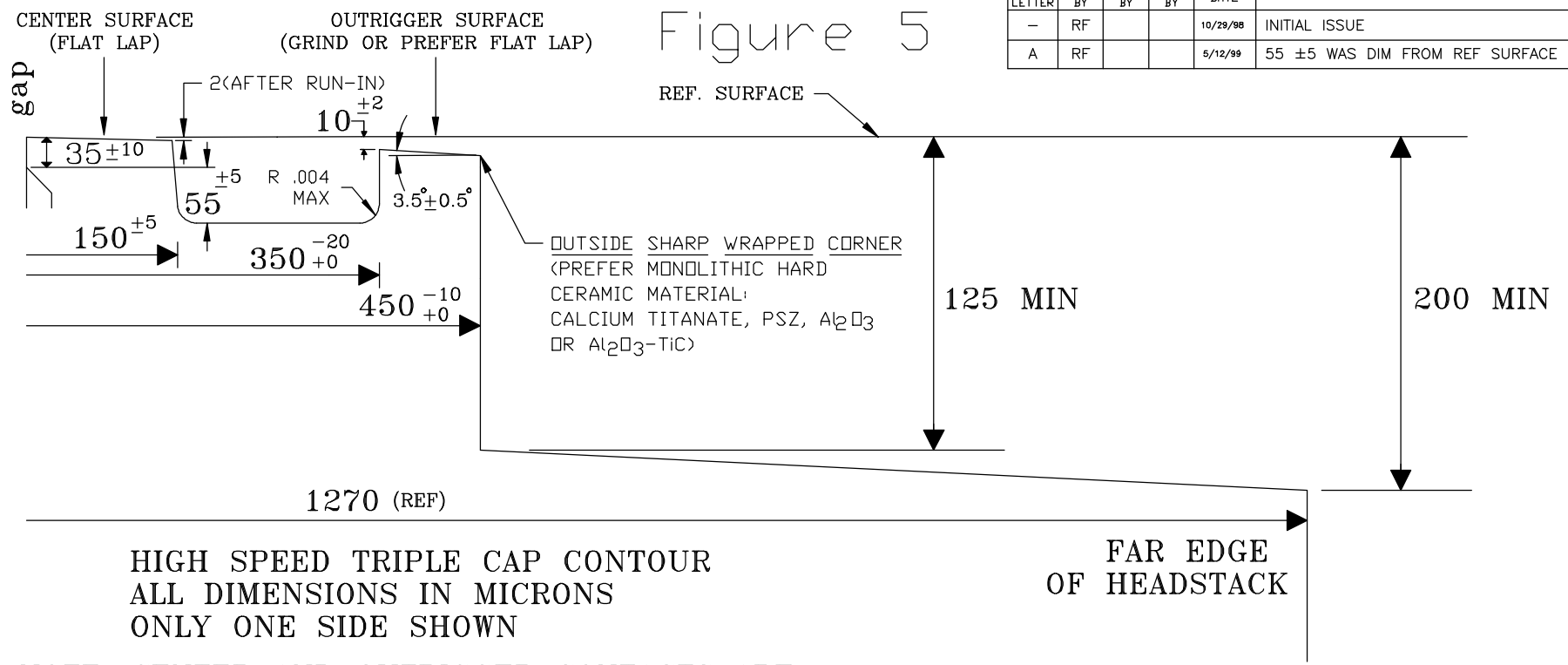
CONTOUR INSPECTION BLOCK
MKIIIA / VLBA / MKIV
COMPATIBLE HEADSTACK

CAD FILE: 6311024.DWG
6/18/98

6311-24 REV D

CHANGE LETTER	D'WN BY	CHK'D BY	APP'D BY	DATE	D.C.N. & DESCRIPTION
–	RF			10/29/98	INITIAL ISSUE
A	RF			5/12/99	55 ±5 WAS DIM FROM REF SURFACE

Figure 5



HIGH SPEED TRIPLE CAP CONTOUR
ALL DIMENSIONS IN MICRONS
ONLY ONE SIDE SHOWN

NOTE: CENTER AND OUTRIGGER CONTACTS ARE APPROXIMATELY ON A RADIUS OF 6000µm. (RADIUS LAP NOT REQD).

SHOP NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE IN INCHES
2. TOLERANCE ON DIMENSIONS
   FRACTIONAL ? 1/64
   DECIMAL .XX ? .01
   DECIMAL .XXX ? .005
   ANGULAR ? 0?'
3. SURFACE ROUGHNESS PER MIL-STD-10 ✓
4. REMOVE BURRS AND BREAK SHARP EDGES 1/64 MAX.
5. SCREW THREADS PER MIL-STD-9
6. ALL DIMENSIONS TO APPLY BEFORE PLATING OR CONVERSION COATING.

USED ON

NEXT ASSEMBLY

WEIGHT

SCALE

CLASSIFICATION

APPROVALS		
	PROJECT	
	ENGINEER	
	MATL. & PROCESS	
	STRUCTURES	
	THERMAL	
	MECH. ANALYSIS	

		DATE
DRAWN FOR	PETER BOLIS	10/28/98
DRAWN BY	(R. CADY) RON FILOSA	10/28/98
CHECKED BY		

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS

TRIPLE CAP CONTOUR
(SQUARE SLOT)

CAD FILE	DWG. SIZE	DWG. NO.	REV.
B330K003.DWG	B	54330K003	A

MFR:_____

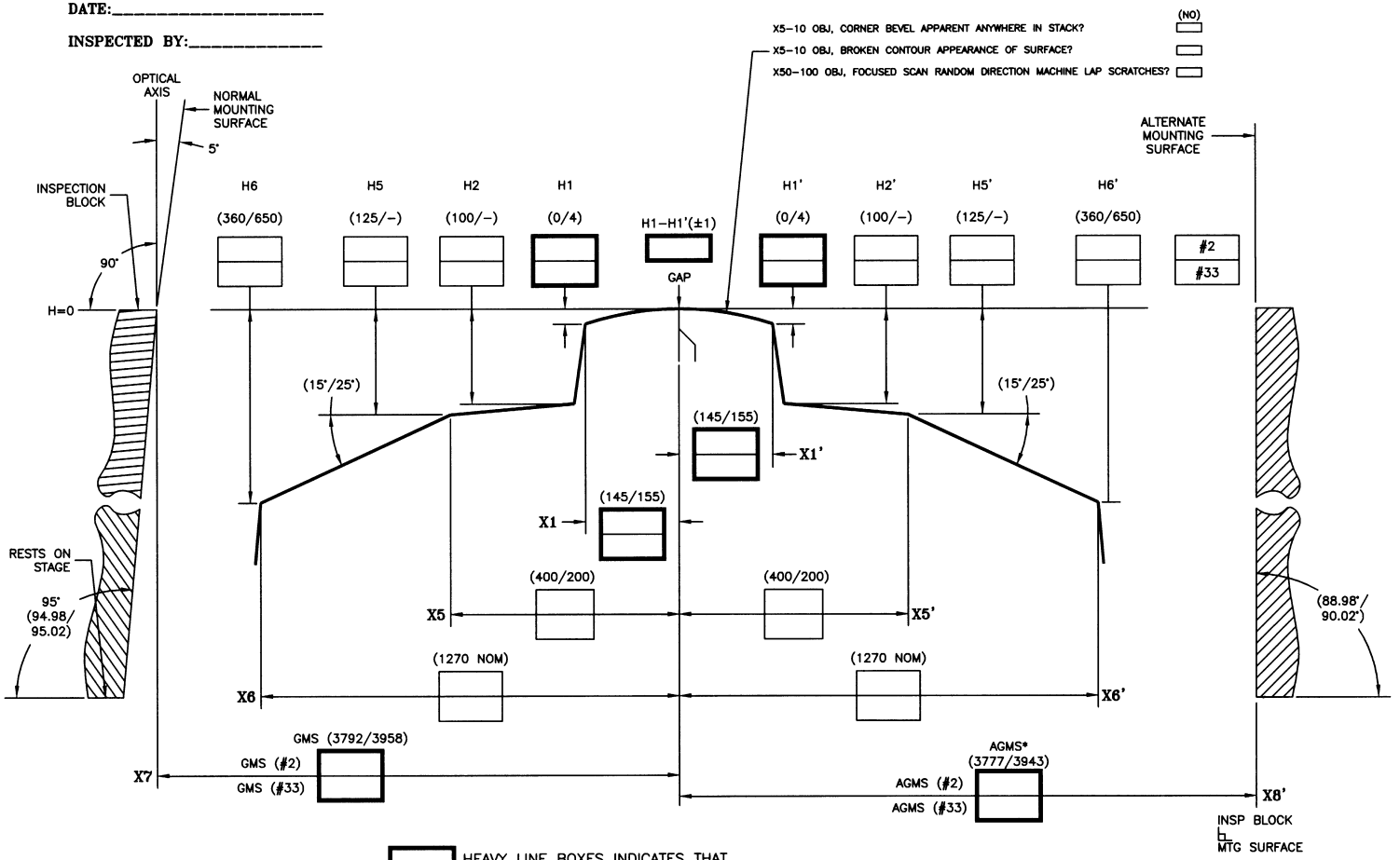
P/N:_____

SER#:_____

DATE:_____

INSPECTED BY:_____

Insp. Sheet No. 1.a



HEAVY LINE BOXES INDICATES THAT INSPECTION ENTRY IS REQUIRED

MEASUREMENTS ARE IN MICRONS, TAKEN AT: CHANNEL # 2, NEAR LOW C'BORE HOLE, FAR END IN THIS VIEW, AND CHANNEL #33, NEAR HIGH HOLE END

GMS(#2)-GMS(#33) (-10/+10)

AGMS(#2) - AGMS(#33) (-10/+10)
*JIVE REQUIREMENT, ONLY AGMS MEASUREMENTS USE ⊾ MTG SURFACE OF INSP BLOCK AND ALT MTG SURFACE OF HEADSTACK

VLBI STEPPED CONTOUR
INSPECTION SHEET #1a
H. HINTEREGGER 06/18/98
CAD FILE: INSPECTS.DWG REV C

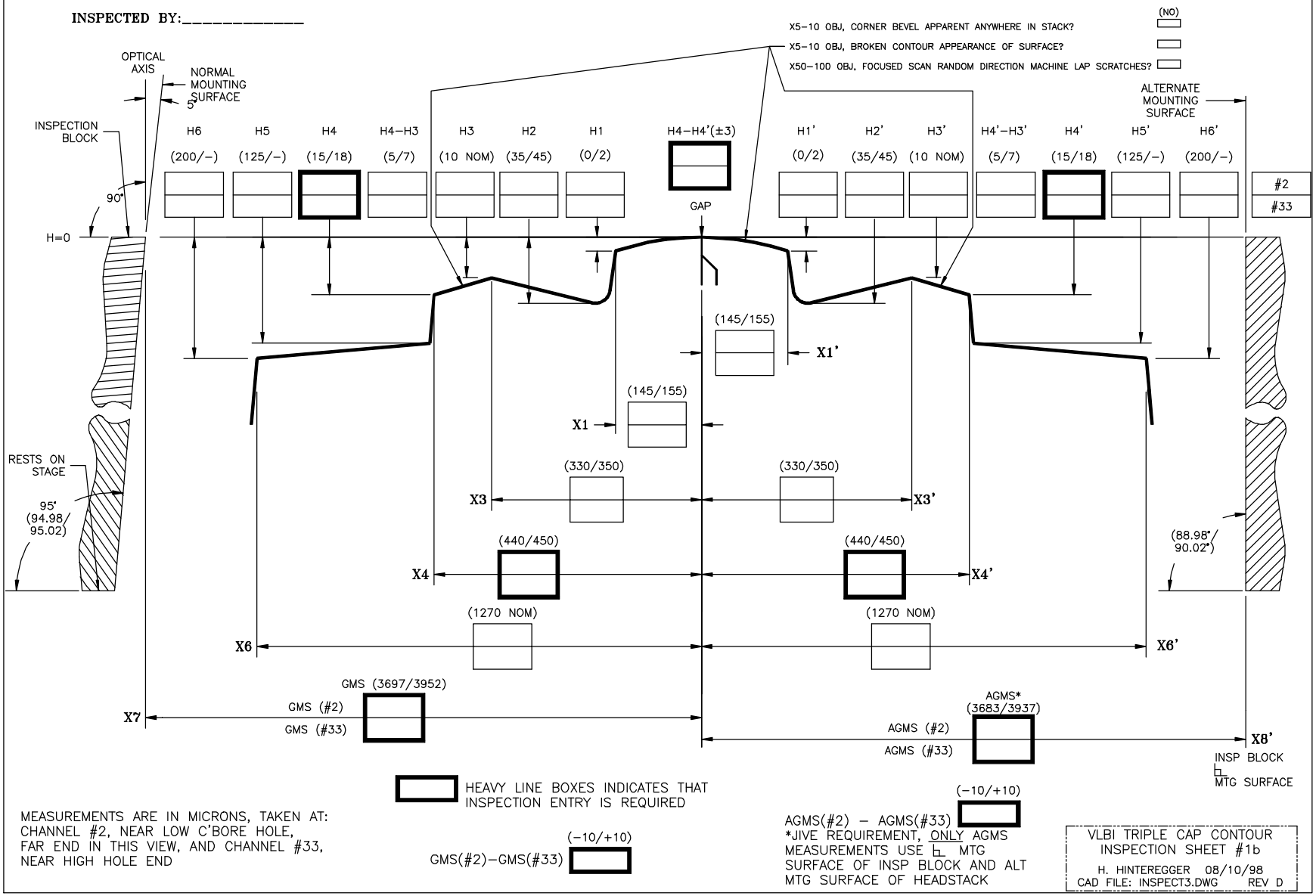
MFR:_____

P/N:_____

SER#:_____

DATE:_____

INSPECTED BY:_____



HEAVY LINE BOXES INDICATES THAT INSPECTION ENTRY IS REQUIRED

MEASUREMENTS ARE IN MICRONS, TAKEN AT:
CHANNEL #2, NEAR LOW C'BORE HOLE,
FAR END IN THIS VIEW, AND CHANNEL #33,
NEAR HIGH HOLE END

GMS(#2)-GMS(#33) (-10/+10)

AGMS(#2) - AGMS(#33) (-10/+10)

*JIVE REQUIREMENT, ONLY AGMS MEASUREMENTS USE ⊾ MTG SURFACE OF INSP BLOCK AND ALT MTG SURFACE OF HEADSTACK

VLBI TRIPLE CAP CONTOUR
INSPECTION SHEET #1b

H. HINTEREGGER 08/10/98
CAD FILE: INSPECT3.DWG REV D

Stepped and Triple-Cap Headstack Specifications for VLBI Recorders

Inspection Sheet No. 2: Head Edge Location Measurement Sheet

Attached is an example of head edge location measurements, (See spec 1.4). Note that in this example the head number labeling conforms to the old specification, 1-36. The measurements included with new headstacks should conform to the VLBA head numbering convention, 0-35, which is not only offset by one but also inverted with respect to the "old" specification, as indicated in the plot. In addition to the data sheet a chart similar to the one attached should be generated.

The specification of +/- 3 μm worst case edge location residual applies to the sum of the magnitude of worst case residual and certifiable worst case measurement error in excess of 0.3 μm.

In general we recommend that all documentation be provided in machine-readable form.

Insp. Sheet No. 2/2

2 Aug 1997
09:58:07

HP Laser Measurement System 5528A -- HP Program 'LASER14'
Abs. Bar. Press.: 24.52 in Hg 70.0 Deg. F 44% Rel. Humidity
Velocity of Light Compensation Factor: 778.6
Material coefficient of expansion: 10.7 ppm per deg C

METRUM Part No. 16819211-
Mechanical Specifications:
Head Edge Location Tolerance: +/- .003 mm
Head Pitch: 0.6985 mm
Head Width: 0.0381 mm
No. of Heads per Stack: 36

Head Stack Serial No.: K74

Head No.	Head Edge Location Rdg (mm)	Nominal Location (mm)	Best Fit Rdg - Nom (microns)	Best Fit Cntrln - Nom (microns)	Head Width Msrd - Nom (microns)
1	0.0000	0.0000	-1.8	-1.7	.1
	.0382	.0381	-1.7		
2	.6982	.6985	-2.1	-1.8	.5
	.7368	.7366	-1.6		
3	1.3963	1.3970	-2.5	-2.1	.8
	1.4352	1.4351	-1.7		
4	2.0948	2.0955	-2.5	-2.3	.3
	2.1332	2.1336	-2.2		
5	2.7941	2.7940	-1.7	-1.3	.8
	2.8330	2.8321	-.9		
6	3.4921	3.4925	-2.2	-1.9	.6
	3.5308	3.5306	-1.6		
7	4.1908	4.1910	-2.0	-1.4	1.2
	4.2301	4.2291	-.8		
8	4.8904	4.8895	-.9	-.4	1.0
	4.9295	4.9276	.1		
9	5.5891	5.5880	-.7	-.3	.7
	5.6279	5.6261	0.0		
10	6.2875	6.2865	-.8	-.5	.6
	6.3262	6.3246	-.2		
11	6.9856	6.9850	-1.2	-.1	2.1
	7.0258	7.0231	.9		
12	7.6839	7.6835	-1.4	-.7	1.3
	7.7233	7.7216	-.1		
13	8.3835	8.3820	-.3	0.0	.6
	8.4222	8.4201	.3		
14	9.0816	9.0805	-.7	-.2	.9
	9.1206	9.1186	.2		
15	9.7806	9.7790	-.2	-0.0	.3
	9.8190	9.8171	.1		
16	10.4787	10.4775	-.6	-.1	1.0
	10.5178	10.5156	.4		
17	11.1765	11.1760	-1.3	-.4	1.7
	11.2163	11.2141	.4		
18	11.8752	11.8745	-1.1	-.1	1.9
	11.9152	11.9126	.8		

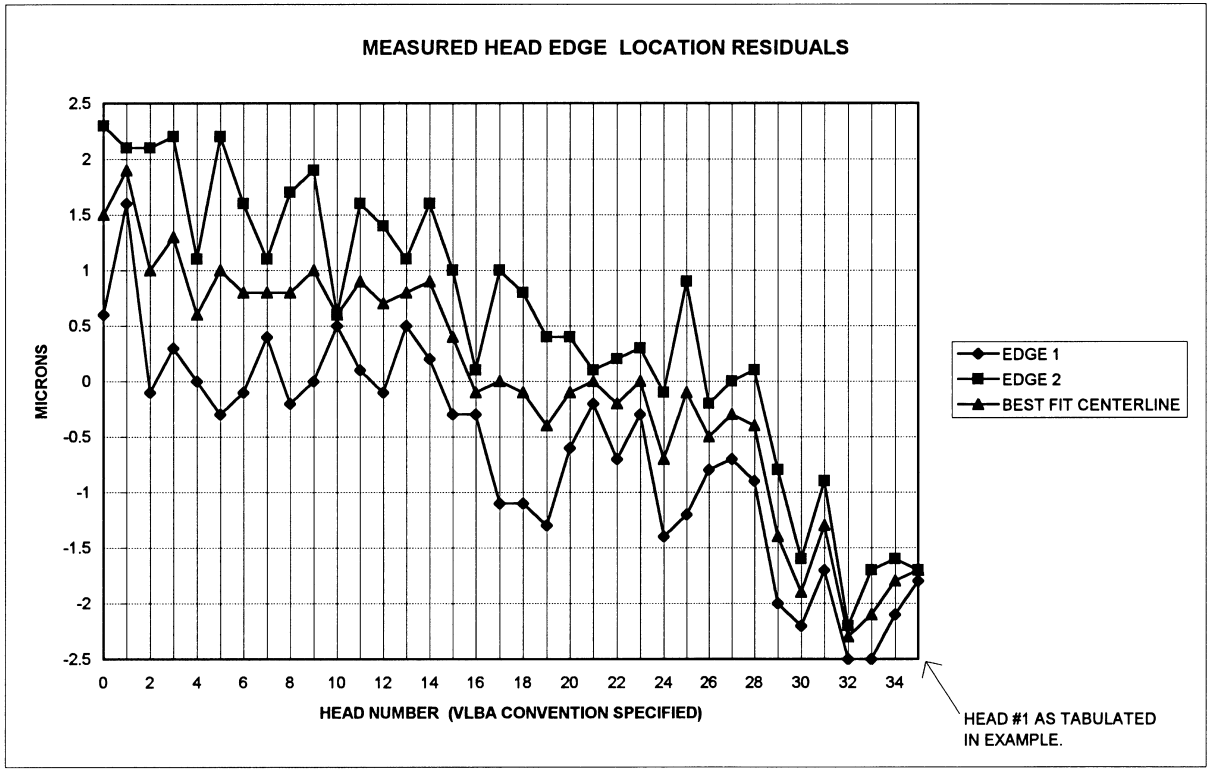
Insp. Sheet No. 2/3

Head Stack Serial No.: K74

Head No.	Head Edge Location Rdg (mm)	Nominal Location (mm)	Best Fit Rdg - Nom (microns)	Best Fit Cntrln - Nom (microns)	Head Width Msrd - Nom (microns)
19	12.5737	12.5730	-1.1	-0.0	2.1
	12.6139	12.6111	1.0		
20	13.2730	13.2715	-.3	-.1	.4
	13.3115	13.3096	.1		
21	13.9715	13.9700	-.3	.4	1.3
	14.0109	14.0081	1.0		
22	14.6705	14.6685	.2	.9	1.4
	14.7100	14.7066	1.6		
23	15.3693	15.3670	.5	.8	.6
	15.4080	15.4051	1.1		
24	16.0672	16.0655	-.1	.7	1.5
	16.1068	16.1036	1.4		
25	16.7659	16.7640	.1	.9	1.5
	16.8055	16.8021	1.6		
26	17.4648	17.4625	.5	.6	.1
	17.5030	17.5006	.6		
27	18.1628	18.1610	0.0	1.0	1.9
	18.2028	18.1991	1.9		
28	18.8611	18.8595	-.2	.8	1.9
	18.9011	18.8976	1.7		
29	19.5602	19.5580	.4	.8	.7
	19.5990	19.5961	1.1		
30	20.2582	20.2565	-.1	.8	1.7
	20.2980	20.2946	1.6		
31	20.9565	20.9550	-.3	1.0	2.5
	20.9971	20.9931	2.2		
32	21.6553	21.6535	0.0	.6	1.1
	21.6945	21.6916	1.1		
33	22.3541	22.3520	.3	1.3	1.9
	22.3941	22.3901	2.2		
34	23.0522	23.0505	-.1	1.0	2.2
	23.0925	23.0886	2.1		
35	23.7524	23.7490	1.6	1.9	.5
	23.7910	23.7871	2.1		
36	24.4499	24.4475	.6	1.5	1.7
	24.4897	24.4856	2.3		

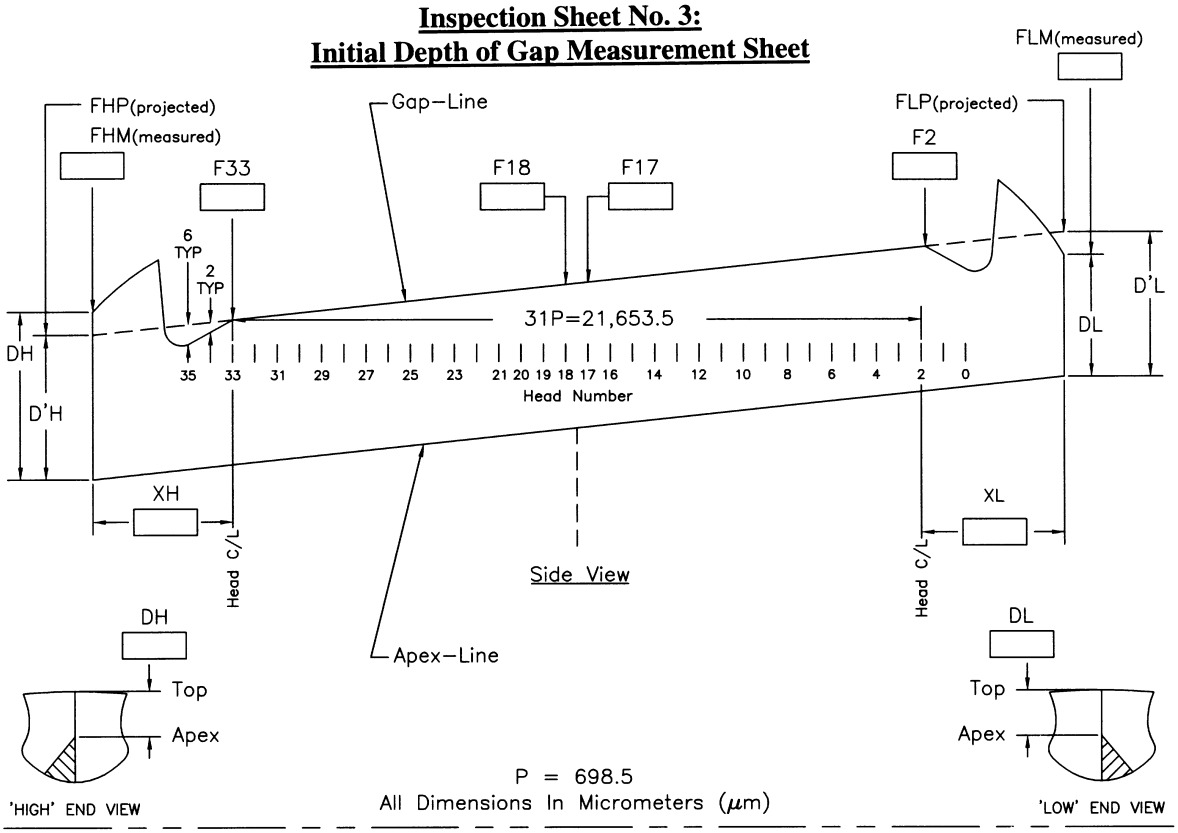
Mean Track Width: .03925 mm Mean Track Pitch: .69859 mm

SAMPLE OF MEASURED HEAD EDGE LOCATION RESIDUALS



Stepped and Triple-Cap Headstack Specifications for VLBI Recorders

Inspection Sheet No. 3:
Initial Depth of Gap Measurement Sheet



DEPTH–OF–GAP CORRECTED FOR: (a) CONTOUR–END ROLLOFF, (b) WEAR BY TAPE

Notes:

0. Use X100 objective for focus height measurments
1. Headstack doesn't need to be levelled accurately for 'F' (Focus height) measurements.
2. 'F' assumed positive in down (depth) direction
3. 'F' = 0 at arbitrary point along Gap–Line, conveniently at highest 'F' of {FLM, FHM, F2, F33}
4. Check repeatibility of 'F' measurements, to 1 μm plus or minus max
5. Gap–Line Bow: (F2 + F33 –F17–F18)/2 = [ ]
6. DH, DL end view distances between Top of contour and Apex (measure within 1μm with X50 LWD objective)
7. All 'F' measurements at Gap–Line
8. XL, XH measured with stage micrometer. positive by definition ~ 3,700 typical
9. Initial minimum Depth–of–Gap spec, with worst case estimated measurement error added, applies to D'H and D'L
10. FLP = F2 + XL{F2 –F33}/31P = [ ] FHP = F33–XH{F2–F33}/31P = [ ]

D'H = DH–(FHP–FHM) = [ ] (27/–), assuming worst case error = 1.6
D'L = DL–(FLP–FLM) = [ ] (27/–),

Depth–of–Gap of head #N: DN = D'L + (D'H–D'L)(XL–2P+NP)/(XL+XH+31P), assuming 1.) straight Apex–Line, and 2.) straight Gap–Line

Note, as a result of normal tape wear: a.) Gap–Line tends to remain straight from #2 thru #33 within ± 1μm
b.) #0 and #35 tend to wear ~ 6μm deeper than straight–line fit, and
c.) #1 and #34 tend to wear 2–3μm deeper than straight–line fit

[ ] HEAVY LINE BOXES INDICATES THAT INSPECTION ENTRY IS REQUIRED

DEPTH–OF–GAP
INSPECTION SHEET
H. HINTEREGGER 06/18/98
CAD FILE: INSPECTD.DWG REV B

Stepped and Triple-Cap Headstack Specifications for VLBI Recorders

Inspection Sheet No. 4:

Electrical Performance Documentation Sheet

The specification applies to the better direction and the best available recorded track regardless of write direction speed. The direction difference in output must not exceed 1 dB.

In the Example the recording used was later found to be 2dB degraded or suboptimally recorded, so that corrected or correctly measured SNR's are actually correspondingly higher.

In the example the test recording is not traceable; it should be.

The user should be able to reconcile the manufacturer's SNR measurements with his own within +/- 0.5 dB when using a piece of same reference recording and same preamp design.

A plot of performance vs. head number is desirable.

P.O.# 45000 4633C

Insp. Sheet No. 4/2

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Narrow Track Stack Electrical Test
Test by Michael J. Perez

PART NUMBER: 16819211-006
SERIAL NUMBER: K95

Serial end D.O.G. .0017 in/ .04318 mm
Blank end D.O.G. .00165 in/ .04191 mm
FACET LAPPED

Test Tape ID: SONY DIK

TAPE SPEED 160 IPS @ 10in. WATER VACUUM
30KHZ SLOT SNR @ 4.4 MHz 20 dB Minimum
Data procured using HP3585A Spectrum Analyzer

Center Frequency - 4.4 MHz
Video BW - 1 Hz
Sweep Time - 400 msec

Frequency span - 0 Hz
Resolution BW - 30 KHz
Marker - 400 msec

RWC115

F-R	TRACK	FWD dBm	REV dBm	NOISE dBm	SNR dBm		F-R	TRACK	FWD dBm	REV dBm	NOISE dBm	SNR dBm	
+0.7	1	-48.2	-48.9	-68.9	20.7		+0.7	0	-47.4	-48.1	-68.5	21.1	
+0.9	3	-47.0	-47.9	-67.9	20.9		+0.1	2	-46.5	-46.6	-67.8	21.3	
+0.5	5	-47.1	-47.6	-68.2	21.1		+0.1	4	-47.7	-47.8	-68.2	20.5	
-?	7	-47.0	-46.8	-67.8	21.0		+0.9	6	-46.0	-46.9	-67.8	21.8	
+0	9	-46.2	-46.4	-67.4	21.2		-0.1	8	-45.9	-45.8	-67.3	21.5	
-0.3	11	-47.7	-47.4	-67.8	20.4	MIN	+1.5	10	-44.8	-46.3	-67.4	22.6	
+0.4	13	-46.9	-47.3	-68.3	21.4		+1.9	12	-46.0	-47.9	-68.4	22.4	
+0.5	15	-45.9	-46.4	-67.6	21.7		+0.8	14	-44.3	-45.1	-67.7	23.4	MAX
+0.1	17	-47.3	-47.4	-68.0	20.7		+1.0	16	-44.5	-45.5	-67.8	23.3	
+0.4	19	-45.6	-46.0	-67.0	21.4		+0.6	18	-43.8	-44.4	-67.0	23.2	
+0.1	21	-46.4	-46.5	-67.4	21.0		+0.4	20	-45.0	-45.4	-67.4	22.4	
-0.4	23	-47.1	-46.7	-67.4	20.7		+0.8	22	-44.5	-45.3	-67.2	22.7	
.5	25	-47.8	-47.3	-67.8	20.5		+0.8	24	-45.9	-46.7	-67.8	21.9	
0	27	-46.5	-46.5	-67.3	20.8		-0.1	26	-46.7	-46.6	-67.5	20.9	
+0.1	29	-47.2	-47.3	-67.7	20.5		+0.7	28	-46.7	-47.4	-67.9	21.2	
+0.8	31	-47.1	-47.9	-67.6	20.5		0	30	-46.8	-46.8	-67.6	20.8	
+0.5	33	-45.5	-46.0	-66.1	20.6		-0.4	32	-45.6	-45.2	-66.3	21.1	
+0.2	35	-45.1	-45.3	-65.7	20.6		+0.4	34	-44.8	-45.2	-65.8	21.0	