

MARK IV MEMO #144  
VLBA ACQUISITION MEMO #352

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To: Mk3A, VLBA, Mk4

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Re: HEADSTACK SPECIFICATION for Mk3A/VLBA/Mk4 COMPATIBILITY (REF. DWG. 6310-116)

0. KEY MECHANICAL SPECIFICATIONS:

HEADS per STACK: 36

HEAD PITCH: .0275" [0.6985 mm]

HEAD WIDTH: .0015" [0.0381 mm]

HEAD EDGE LOCATION TOLERANCE: +/-0.00012" [0.003 mm]

[worst case out of 72 w/r best fit ideal pattern at 23 C]

1. OVERALL DIMENSIONS: LxWxH = 1.5605" x 0.305" x 0.400"

2. GAPLINE-to-MOUNTING-SURFACE distance: .1495/.1505" [average, (#1+#36)/2, where #1 is distance at head #1]; GL and MS to be parallel to within .0005" [|#1-#36| not to exceed .0005"]

3. CONTOUR ROTATION ANGLE: 4.8/5.2 degrees, counterclockwise when viewed from end closest to head #1. The 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 plane tangent to the contour at the gapline.

4. HEAD NUMBERING CONVENTION, INTRINSIC: When viewed from the side opposite the mounting side with the tape-bearing step up, the intrinsic head numbers increase from left to right, from #1 to #36. The intrinsically 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.

5. MOUNTING HOLES: The high (left in 4.) hole is .180" and the low (right in 4.) hole .320" below the step (top of headstack). Thru-hole diameter is .078" and the .136" counterbore is .105" deep. The holes are .080" from the ends. The headstack is mounted with 0-80 screws, using an alignment jig.

6. END TRIM: .2985/.2995" from either end to center of nearest head, #1 and #36 respectively. Precision end trim -- with .001 in/in perpendicularity to gapline -- is needed on both ends for consistent mounting in-out alignment with either end out. Trimmed headstack length implied is 1.5595/1.5615", since the distance between #1 and #36 is .9625".

7. GAP APEX-LINE STRAIGHTNESS: .0001" [2.5 um] maximum bow in depth-of-gap direction. Proof of process conformance required.

8. CONNECTORS: pair of 40-pin AMP# 1-203990-7 connectors, mounted flush with bottom of stack, centered with .025" spacer between them. Must be securely fastened; epoxy must not wick into sockets. Odd

or even heads are wired in order, with consistent polarity, to the central 36 sockets of each connector.

9. INITIAL DEPTH of GAP: specifiable from .0012" to .0024" with tolerance to +/- .0001". Both tip-plate ends must be optically observable in cross-section [end-view] to permit inspection for initial depth of gap [and contour detail]. End-to-end difference in initial depth of gap is not to exceed .0001". Original performance specification applies to heads with depth of gap  $\geq$  .0012". [Note: Some stacks with .0020" depth of gap have all heads 4dB or more above the 24dB minimum SNR per our standard test. Well-made heads should pass the read performance acceptance test requirement at .0024" and exhibit uncompromised write performance at this initial depth of gap, provided the gap is long enough. In the future some stacks may be ordered with a nominal initial depth of gap of .0024", to be used in their first half-life as write-monitor stacks in field data-acquisition recorders and in a second half-life (with depth of gap less than .0012", for best read performance) on a processor drive. This maximizes total headlife, makes write performance most consistent, provides highest read SNR, and permits wear-out only during read operation.]

10. GAP LENGTH: 320/380 nm

The definitive test for conformance is measurement of gap null wavelength = 1.1 x gaplength. Present specification is for non-MIG ferrite headstack which must write 900 Oe oxide tape. [Shorter gaps, more tightly controlled, may be required for future MIG headstacks.]

11. CONTOUR: For symmetry, assume measurements with stack mounted on 5 deg wedge, mounting side high.

STEP-EDGE-to-GAP DISTANCE: .0059/.0061"

OFF-STEP CONTOUR: 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 step edge at 5 deg [half wrap-angle]. This is 8 m/s anti-flying requirement, which can be met, for example, with:

Depth-of-Step: .0030/.0034" below gap apex with .003/.004" corner radius suggested at bottom of step. [Alternatively, with small  $<$  .0005" corner radius (not recommended), depth at .0065" distance from gap must be .0022/.0026" below the apex, and the flat portion of the bottom of the step must be tilted at least 5 deg in the same direction as the off-step contour angle.]

Off-Step-Contour-Angle: 22/23 deg suggested, grind and/or lap both sides.

[If the flat bottom of the step is normal to the symmetry plane, the transition to the off-step contour angle should be less than .015" from gap.]

A secondary relief step may be used to satisfy the off-step-contour requirement if, for example, it is too difficult to hold the contour peak height accurately enough.

TAPE-BEARING [STEP] RADIUS: .09/.11" (4/5 um contour height at gap w/r step edges)

[Any specified radius can be closely approximated with a suitable faceting machine. Two facets at +/- 1.7 deg leave the gapline and step edges about 1.1 um high with respect to a 0.10" radius arc which is tangent at the mid-facet points.]

TAPE-BEARING [ON-STEP-CONTOUR] ANGLE ERROR: +/- 0.20 deg max, (one um max difference in focal height between the step edges)

CONTOUR-END to HEAD-PATTERN-CENTER DISTANCE: 0.560" minimum

TAPE-BEARING SURFACE QUALITY: Epoxy glue lines not to exceed .0002" width; bubbles in glass or epoxy not to exceed .0002" diameter.

12. INDUCTANCE: 20/25 uH, measured at 250 KHz.

[Original design uses 48 turns of #50 wire, resistance < 5 ohms, resonance with about 4 pF load about 12 MHz, optimized for read at 9-18 Mbps formatted NRZ data rate. MkIIIA standard is 4.5 Mbps, VLBA 9 Mbps, MkIV 18 Mbps. Future headstacks may be optimized for higher data rates and compatibility with disc read/write ICs.]

#### FOR REFERENCE:

0. APPLICATION: Write or read 1"-wide 700 Oe [type C] video tape at 1.33 fc/um or 900 Oe D1/SVHS-equivalent tapes at 2.25 fc/um.

#### 1. MATERIALS:

HEAD TIPS: single-crystal MnZn-ferrite [Hitachi HS-3]; oriented (211) tape bearing plane, (110) cross-section plane [end of gapped bar], (111) side of gapped bar [like Hitachi bar used by Metrum]. Other sources NGK, Sony, etc..

SPACERS (dominant tape bearing mat'l): Calcium titanate (3M851D) original version is somewhat too wear resistant and produces some spacing loss due to head recession. Corning Fotoceram version is not wear resistant enough although performance is easily maintained. Hitachi MN-130 experimental version is not yet tested and optimum tribomatched material is still sought.

#### 2. COMPATIBILITY:

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 Honeywell [now Metrum] 96 drive.

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.

READ PERFORMANCE SPECIFICATION [original]: SNR  $\geq$  24 dB, all heads [for gap depth  $\geq$  .0012"],

A. when reading MkIII formatted test [bidirectional] recordings of random noise [with 9-bit odd-parity NRZM channel code at 1.33 fc/um],

B. at speed of 135 ips bidirectionally [output for SNR taken as the larger of F/F and R/R values],

C. in a 30 KHz [resolution bandwidth] slot [centered at 2.2 MHz -- to avoid 'parity pip' at 2.25 MHz bandedge],

D. noise level measured with tape stopped,

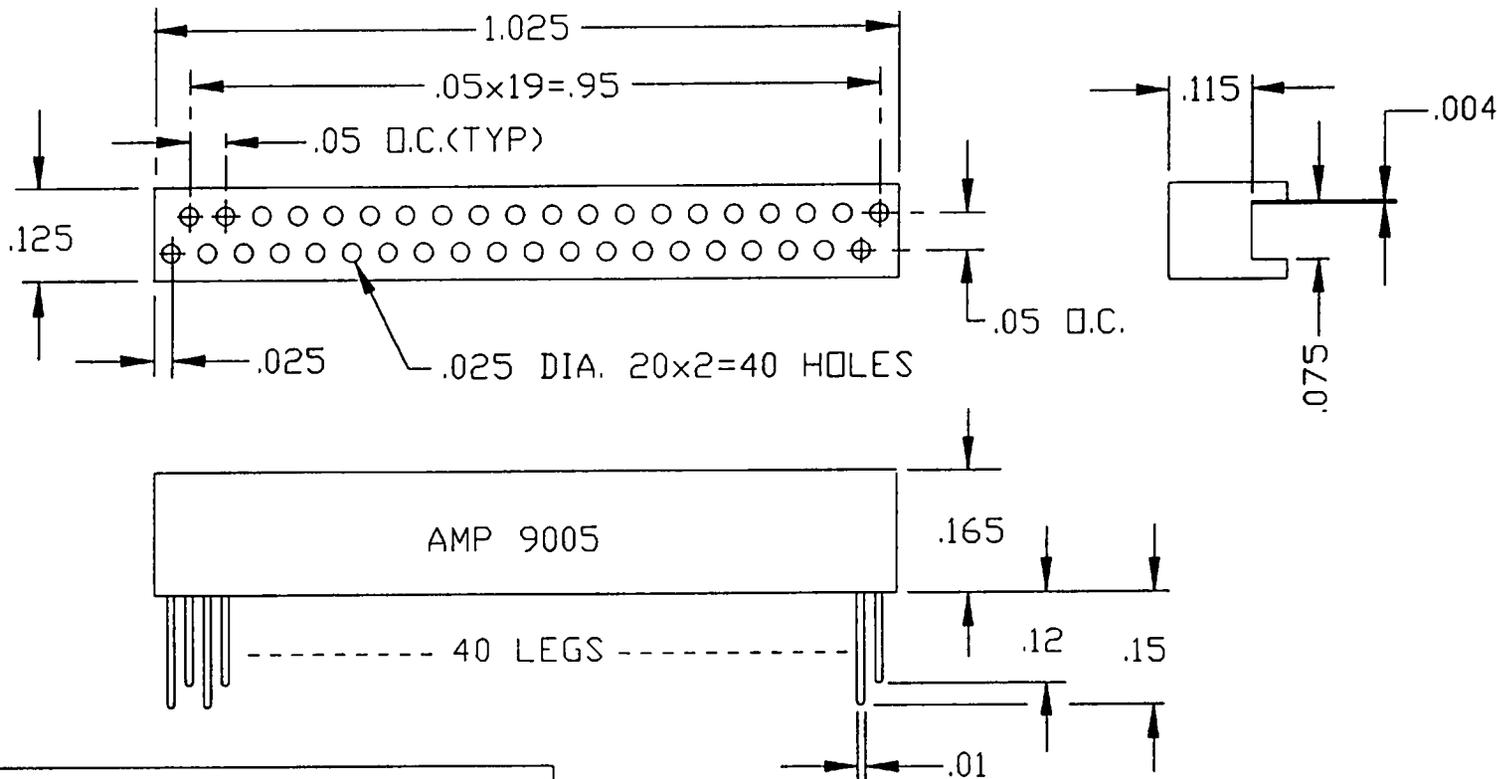
E. using recorded Fuji H621 test tapes, supplied by Haystack [can be checked for degradation with master reference headstack as needed],

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

Note: Test condition update to SonyD1K, 3M5345, or Ampex741 tape at 2 m/s at 2.25 fc/um and larger minimum depth of gap is desired for VLBA/Mk4.

CHANGE LETTER	BY	CHK'D BY	APP'D BY	DATE

D.C.N. & DESCRIPTION



**NOTES:**

1. SEE DWG. C-6310-116 FOR COMPATIBLE HEADSTACK SPECIFICATIONS.

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

SHOP NOTES: UNLESS OTHERWISE SPECIFIED

- DIMENSIONS ARE IN INCHES
- TOLERANCE ON DIMENSIONS  
FRACTIONAL ? 1/64  
DECIMAL .XX ? .01  
DECIMAL .XXX ? .005  
ANGULAR ? 0730'
- SURFACE ROUGHNESS PER MIL-STD-10 ✓
- REMOVE BURRS AND BREAK SHARP EDGES 1/64 MAX.
- SCREW THREADS PER MIL-STD-9
- ALL DIMENSIONS TO APPLY BEFORE PLATING OR CONVERSION COATING.

USED ON

NEXT ASSEMBLY

WEIGHT

SCALE 4x

CLASSIFICATION

DRAWN FOR H.F.HINTEREGGER

DRAWN BY R.J.CADY

CHECKED BY

PROJECT

ENGINEER

MATL. & PROCESS

STRUCTURES

THERMAL

MECH. ANALYSIS

DATE 2/93

DATE 2/93

NORTHEAST RADIO OBSERVATORY CORPORATION  
HAYSTACK OBSERVATORY  
WESTFORD, MASSACHUSETTS

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

A6310117

A

6310-117

FILE NAME

DWG. SIZE

DWG. NO.

REV.

