

**UNCLASSIFIED****SPECIFICATION FOR A MAGNETIC TAPE RECORDER-REPRODUCER SYSTEM USING A  
LONGITUDINALLY ROTATING REPRODUCE HEAD ASSEMBLY****INTRODUCTION**

The following specifications are intended to describe an instrumentation magnetic tape recorder-reproducer which is modified to permit repeated reproduction of data from a relatively short length of tape. The system includes the standard tape transport designed to use both 1/2" and 1" tape, with standard record and reproduce heads and amplifiers, with modifications to include a rotating reproduce head assembly in an optional tape path, a motor drive assembly and reproduce amplifiers for the rotating head reproducer system. The axis of rotation of the rotating head assembly is to be parallel to the tape surface and perpendicular to the tape motion.

**A. TRANSPORT**

The transport is intended to be a standard product which has been modified to accommodate the rotating reproduce head assembly. It is anticipated that the GFE unmodified transport will be either a CEC model GR-2500 or GR(VR)-2800. If the GR-2500 recorder is supplied, an empty matching cabinet will also be supplied.

1. The transport will be designed to accommodate both 1/2" and 1" wide, 1.0 or 1.5 mil mylar tape. The transport to be furnished will be equipped to handle 1/2" wide tape. The transport design will permit use of either 10 1/2" or 14" diameter NAB reels.

2. Standard 7 track interlaced IRIG compatible record and reproduce heads will be provided.

3. The transport will be capable of operation at the following tape speeds through a combination of belt changes and electrical motor speed changes: 1.875, 3.75, 7.5, 15, 30 and 60 inches per second.

**B. THE ROTATING REPRODUCE HEAD ASSEMBLY**

This assembly includes the rotating head wheel, components for transfer of the reproduced signal from the rotating head, a motor drive assembly and a precision mounting plate.

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1. A requirement exists for a mechanism which will scan a four inch length of tape 15 or 30 times per second (electrically selectable at the operator's option). A scan length of eight inches, also operable at either 15 or 30 scans per second, is desirable if the physical design of the head wheel is such that both scan lengths can be obtained by a change of tape path and disconnection of one pair of heads in the head wheel. If a scan length of eight inches is required and the design of a rotating head as described above is not feasible, the use of two interchangeable head wheels to accomplish the change of scan length is permissible. The circumferential gap to gap spacings shall be  $4.000" \pm 0.007"$  and  $8.000" \pm 0.010"$ .

2. The head wheel or wheels shall have heads mounted which correspond to tracks 1, 3, 5 and 7 of the IRIG seven track configuration. It is desirable that the head wheel or wheels also have heads for reproducing data from tracks 2, 4 and 6 of the same configuration. Each track shall have two gaps or an integral multiple thereof.

3. The rotating head shall be designed for operation with 1/2" wide tape only. The design of the head wheel mounting assembly shall permit use of head wheels for scanning tape lengths up to 16". The design of the mounting assembly shall not preclude a tape width change from 1/2" to 1" tape by the replacement of head wheels, tape guides and signal transfer components.

4. The axis of rotation of the head wheel shall be parallel to the tape surface and perpendicular to the tape motion.

5. The gaps in each head stack shall lie within a band 100 micro-inches wide.

6. Care shall be taken to design tape guidance prior to, during and after contact with the rotating head to minimize flutter and inter-track time displacement error of signals reproduced by the rotating head.

7. The peripheral velocity of the rotating head shall be held within 0.05% of the nominal under any combination of tape speed (including tape stopped), reel size, head wheel size, scan rate, tape wrap angle, or position of the data within the reel. The angular flutter of the rotating head wheel shall not be greater than 0.3% peak-to-peak measured over a flutter bandwidth of 0.5 to 300 cps under any combination of conditions outlined above.

8. Care shall be taken to minimize head and tape wear. Control of tape tension shall be maintained when tape motion is stopped to permit accurate measurement of data from the rotating reproduce head.

9. Components used to transfer signals from the rotating head wheel should not require periodic replacement for reasons of mechanical wear or deterioration.

10. The rotating head assembly will be used to reproduce data recorded by either direct or single carrier FM techniques. The limits of the recorded wavelengths for the FM recordings are 0.00185" to 0.000795". The limits of the recorded wavelengths for the direct recordings are 0.030" to 0.0005". Head to tape contact for the head wheel shall be sufficiently intimate to permit proper operation of the FM demodulators and to yield a signal-to-noise ratio of 35 db from a 0.0005" recorded wavelength signal at standard level. The bandwidth to be used in making this measurement is ±15% from the nominal reproduced frequency.

11. Cross talk between data outputs shall be minimized. In particular, FM carriers appearing on the outputs from the direct tracks is particularly damaging.

12. Noise attributable to rotating head pickup from ambient magnetic fields shall not be greater than -50 db from the output obtained from a signal at any frequency which was recorded at standard level. Standard level is defined as that level which produces 1% third harmonic magnetic distortion of a 1 kc recorded signal. In the case of reproducing data through a direct reproduce amplifier, noise specifically attributable to the means for signal transfer from the rotating head wheel to the final amplifier shall not increase the output noise of the amplifier more than 4 db.

13. A sync pulse, suitable for triggering an oscilloscope sweep circuit, shall be provided at the time each head stack containing tracks 1, 3, 5 and 7 begins scanning the tape. If one head wheel is used to provide scans of both 4" and 8", the sync pulses corresponding to the unused gaps should be disconnected.

14. The rotating head may be either direct or belt driven, subject to the provisions of paragraph B.7. The system shall be operable with the spinning head rotating either with or against the direction of tape motion. The following controls shall be provided for the rotating head: Power, Number of Scans per Second, Direction of Rotation.

15. The rotating head assembly shall be provided with a mechanical shield for personnel protection. The shield shall be provided with an electrical interlock to prevent energizing the head drive when the shield is open for threading tape or maintenance.

16. The rotating head assembly and associated reproduce amplifiers shall meet the electro-magnetic radiation standards as detailed in NAG-1A/TSEC and MIL-I-

### C. ELECTRONICS

1. The record and reproduce electronics for the stationary heads associated with the recorder will be GFE with the recorder. If the GFE is a CEC Model GR-2500, four FM record amplifiers, three direct record amplifiers, one FM reproduce amplifier and one direct reproduce amplifier will be supplied with the recorder, together with a 7x2 reproduce head patch panel. If the GFE is a CEC Model GR(VR)-2800, the number and types of amplifiers will be determined at a later time, however, sufficient amplifiers of each type will be provided to permit all necessary tests.

2. A reproduce amplifier shall be provided for each track which is instrumented in the rotating reproduce head assembly. Tracks 1, 3, 5 and 7 shall be provided with single carrier FM demodulators, equipped with center frequency elements and output filters corresponding to an extension of IRIG standards for the center frequencies obtained by the use of the rotating head. Tracks 2, 4 and 6, if instrumented in the rotating head assembly, shall be provided with direct reproduce amplifiers. These amplifiers shall, with suitable equalization be flat  $\pm 3$  db from 0.0005" to 0.030" recorded wavelength. It is desired that the direct and FM reproduce amplifiers be interchangeable or that it be possible to apply the output from any of the rotating head tracks to any reproduce amplifier. It is anticipated that a given connection of rotating reproduce head tracks and reproduce amplifiers will be used for an extended period, therefore, the latter requirement may be met by a head cable change at the input to the final reproduce amplifiers.

3. The broad-band signal-to-noise ratio for the tracks containing data recorded by direct recording techniques and reproduced by the rotating head system shall not be less than 30 db.

4. A squelch circuit shall be used in the FM demodulators associated with the rotating reproduce head assembly to prevent high amplitude noise output at times that no carrier is present, whether caused by the rotating head being stopped or the absence of a recorded carrier on the tape.

D. GENERAL

1. A list of material subject to high rates of wear or deterioration shall be included. A recommended spare parts list of parts peculiar to this system, together with the cost of providing the full complement of parts listed, shall be included.

2. Instruction manuals for the standard recorder system will be provided. Modifications made in the recorder shall be indicated therein and two complete instruction manuals for the rotating head assembly and associated amplifiers shall be provided.