



Cleaning Methods For Helical Scan Recorders

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1 Introduction

This report contains the current National Media Laboratory (NML) recommendations for the use of cleaning fluids on tape recorders. These recommendations are intended to complement the recommendations of the recorder manufacturers' and not to replace them. Many recorder facilities have used Freon, other chlorofluorocarbons (CFCs), and mixtures involving CFCs for cleaning heads and tape paths. However, new restrictions on CFCs impact these choices. The U. S. has ratified the Montreal Protocol, an international agreement regulating the production of ozone-depleting chemicals. Under the terms of the agreement, production of Freon and other CFCs will be eliminated by 1996. Updates to the Clean Air Amendment of 1990 also affect CFC use and availability. As a result of these restrictions and the escalating costs associated with the use of chlorofluorocarbons, CFCs are fading as viable choices for cleaning recording equipment.

2 Recommendations for Cleaning Fluids

The cleaning fluids recommended by the NML are listed below. The following discussion and Tables 1-2 further describe these cleaners and list precautions to be observed during use.

Recommended Cleaners

Isopropyl Alcohol Recommended for general use. Safe for most recorder components.

Methyl Alcohol Recommended for removing difficult deposits. Safe for guides and rollers. Use sparingly.

Xylenes Recommended for removing difficult deposits. Use sparingly.

Important Usage Notes:

1. Use ACS grade chemicals for cleaning.
2. Always dry-wipe after use.
3. Read all Precautions carefully.
4. See Section 2.1 Precautions regarding capstans and pinch rollers.

Name	Drying Rate	Odor	Effectiveness			
			Loose Head Debris	Tape Smear ¹	Finger-prints	Adhesive Traces ²
Methyl Alcohol	Med.	Alcohol	Good	Good	Good	OK
Isopropyl Alcohol	Slow	Alcohol	Good	Good	Fair	OK
Xylene	Slow	Strong aromatic	Good	Good ³	Good	OK

Notes:

1 D-2 tape coating was softened with methyl ethyl ketone, smeared on a test surface and allowed to dry.

2 Heavy adhesive deposits are very difficult to remove. Tests involved only traces remaining on a glass slide after sticky tape was removed.

3 Xylene is slightly more aggressive.

Table 1. Convenience and Effectiveness of Cleaning Fluids

2.1 Precautions

The Cleaning Agents: These fluids are recommended for use by knowledgeable recorder personnel and are not intended for use in the home. Obtain and consult the MSDS (Material Safety Data Sheet) for any product that is used. The MSDS gives complete information on safety for the product as well as instructions for cleaning spills and disposal of unused or waste material. (See Table 2.)

Regular Cleaning Schedule: Experience has shown that a regular cleaning schedule can prevent many problems. Built-up debris becomes increasingly harder to clean. Head cleaning tapes are required if head-staining occurs. (Head stains are chemically formed and cannot be removed with solvents.) Recommended cleaning schedules vary from 8 to 100 hours of use depending on the recorder and the tape in use as well as the environment of the recorder.

Use Sparingly: Cleaning fluids must be used sparingly to avoid contact with certain bonding agents and/or plastics in the head assemblies. Use of excessive amounts of fluids can spread to or spill on these elements and may have the potential to damage some of them.

Allow Drying Time: Drying time is very important. Allow at least five minutes of air drying time for all parts before loading tape. Any remaining fluid can contact the tape and cause damage. Any fluid that spreads out between the tape and the scanner will increase the friction between them and has the potential to cause damage to both.

Gloves for Protection: Use of Nitrile powder-free gloves is recommended to protect the skin during incidental contact. These gloves were chosen because they have been chemically tested for the recommended solvents and come in thin enough form to allow delicate work. Continued exposure to xylenes may cause a glove to stretch, swell, or leak. If any of these problems occur, replace the glove. The glove manufacturer recommends special precautions with methyl alcohol and these precautions should be carefully read and followed. Powder-free gloves are recommended to avoid contamination of the deck and tape with the powder from the gloves.

Capstans and Pinch Rollers: Follow the manufacturer's recommendations concerning cleaning capstans and pinch rollers. Rubber and some plastic capstans or pinch rollers can swell and ultimately crack when cleaned with most solvents. Also, some manufacturers caution against cleaning certain capstans and certain rollers due to the danger of causing misalignment.

Name	Fire Hazard	OSHA Exposure Limits			Health Effects				
		Still Air*	Room**	Inhalation	Skin Contact	Eye Contact	Ingestion		
Isopropyl Alcohol	Yes f.p. 53°F	400 ppm	983 mg/M3	26 grams - 33 ml	Depressant	Irritant C.N.S.	Mild irritant. Drying Not significantly absorbed.	Moderate Irritant	C.N.S. Depressant
Methyl Alcohol	Yes f.p. 52°F	200 ppm	262 mg/M3	7 grams - 8.8 ml	Depressant	Irritant C.N.S.	Irritant. drying. Readily absorbed.	Moderate Irritant	Causes Blindness
Xylene	Yes f.p. 81°F	100 ppm	434 mg/M3	11.5 grams - 13 ml	Depressant	Irritant C.N.S.	Moderate irritant. Drying. Not significantly absorbed.	Moderate Irritant	C.N.S. Depressant Aspiration Hazard

f. p. - flash point - the lowest temperature at which a vapor can be ignited in air. The vapors are all heavier than air and can travel along

surfaces to a flash point.

ppm - parts per million

C.N.S - Central Nervous System

*Safe daily exposure through working life in still air. There have been no demonstrated effects at these exposures to date.

**Safe daily exposure calculated for a 10 foot x 10 foot x 10 foot room with still air. 4.92 ml = 1 teaspoon.

These levels exceed expected exposure for routine cleaning procedures.

Table 2. Potential Hazards of Cleaning Fluids. Obtain and Consult MSDS (Material Safety Data Sheets) for any products that are used.

2.2 Head Cleaning Procedure

1. Use a lint-free cloth wiper, such as a 4-inch square TexWipe^{reg.} (TX304, 4-inch x 4-inch, 100% Cotton).
2. Fold the wipe once or twice, forming a small, 2 to 4 layered rectangle. Experience will dictate the best method for each recorder.
3. Apply a few drops of the selected cleaning fluid to the center of the folded wipe.
4. Move the heads to a position that allows you to hold a wiping cloth against the slot without touching the heads.
5. With the heads rotated out of the way, lightly press the damp wipe to the scanner surface applying light, even pressure and straddling the slot. *Do not try to press the wipe into the slot between the drum halves* as this may damage the heads in the next step. (One should barely feel the heads contact the wipe.) See Figure 1.

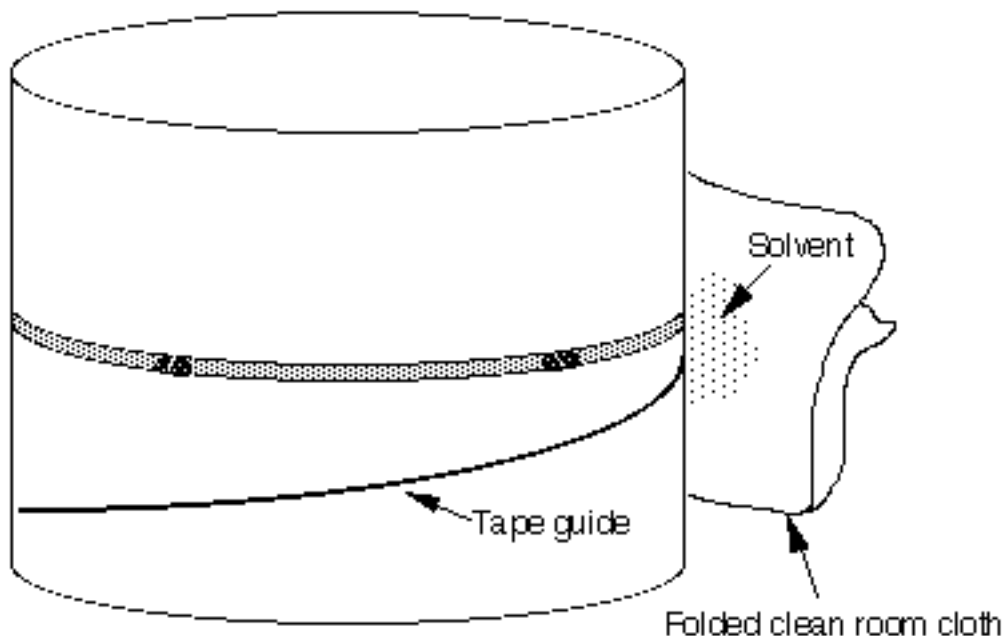


Figure 1. With the heads rotated out of the way, hold the solvent-dampened cloth against the slot. Then rotate the heads past the cloth.

6. Rotate the head assembly slowly two or three complete revolutions in the direction indicated by the manufacturer. (This will be the normal rotation direction for most scanners, but it depends on the shape of the heads.) Hold the wipe steady during this process. Any movement perpendicularly across the scanner slot (sideways across the heads) may damage the heads.
7. If residue is seen on the wipe, repeat with a clean area of the wipe until no residue can be seen.

8. Repeat the procedure using a clean, dry wipe. This usually prevents thin films of residue on the heads and ensures better drying.
9. Use an unfolded, solvent-dampened cloth to clean the surface of the scanner and the tape edge guide (where present). Be sure to rotate the heads out of the way while you are cleaning the scanner. Repeat with a dry cloth.
10. Allow at least five minutes of air drying time to remove traces of cleaning fluid that could damage tape or increase friction between tape and scanner.

2.3 Tape Deck Cleaning Procedure

Lint free cloths moistened with the preferred solvent are also recommended for cleaning parts within the tape path of the tape deck and the linear heads in the system. Use another wipe to dry the tape path. Note the precautions in Section 2.1 concerning capstans, pinch rollers, and other delicate rollers. Failure to allow adequate drying time could result in tape damage. Other methods of cleaning the tape path include foam swabs dampened with the preferred solvent. Unwaxed dental floss can be carefully used to free the debris in the tight corners on tape guides before cleaning with solvents. Dental floss should be used with great caution in cases where alignment could be disturbed. Deck cleaning should always follow any manufacturer's special precautions.

2.4 Discussion

For routine work, NML recommends $\geq 99\%$ ACS Grade isopropyl alcohol for cleaning heads and tape path (see Section 2.1 Precautions for capstans.) Purchase of ACS grade chemicals assures that the solvents meet the standards of purity set by the American Chemical Society. This will eliminate possible sources of residue which might contaminate the tape path. (*Reagent Grade* or *Analytical Reagent Grade* are labels that are sometimes used on ACS grade chemicals.) There are some precautions to observe in the use of the recommended solvents and the "Precautions" section (2.1) at the beginning of this report should be read carefully. The solvents are highly flammable and must be kept away from excessive heat and sources of ignition.

ACS grade isopropyl alcohol is widely used throughout the recording community and users report good results in most cases. Isopropyl alcohol and the other recommended solvents dry slowly compared to Freon. Therefore, it is strongly recommended that wet cleaning be followed by a dry wipe and at least five minutes of air-drying time.

For deposits that may be difficult to remove with isopropyl alcohol, two other cleaners are recommended. ACS grade methyl alcohol is an effective cleaner. Some manufacturers have approved its use and recorder users report satisfaction. Like isopropyl alcohol, methyl alcohol is very flammable and must be kept from heat and sources of ignition. Dry wiping is recommended even though methyl alcohol dries slightly more quickly than isopropyl alcohol. NML does not recommend use of methyl alcohol on rubber capstans, pinch rollers, or other rubber parts unless approved by the recorder manufacturer.

Another effective cleaner is ACS grade xylenes. Ampex [2] approves the use of this cleaner for D-2 heads and tape path with the exception of the capstan. Xylenes have a higher flash point than the alcohols (above normal room temperature), but are still highly flammable. Xylenes dry even more slowly than isopropyl alcohol, so dry wiping followed by at least five minutes of evaporation time is very important. The amounts used for cleaning are not considered hazardous. Xylenes are not known carcinogens or reproductive toxins. A possible drawback to xylenes is their very strong odor which some users find objectionable.

Note: Ethyl alcohol is an effective cleaner that some users find satisfactory. Because ethyl alcohol is regulated as a controlled substance, NMI does not recommend its use. If a recorder site does have access to ethyl alcohol, it can be considered for cleaning. Some recorder sites report satisfactory results. Denatured ACS grade ethyl alcohol is also an option. The same precautions for explosion, drying time, and capstans/pincher rollers apply as with isopropyl and methyl alcohols.

One recorder manufacturer has warned that use of isopropyl alcohol on scanners can leave a persistent residue which affects performance. This is being re-evaluated by the manufacturer, using $\geq 99\%$ ACS grade alcohol. Other users report the least residue with ACS grade isopropyl. These users have had higher residue problems with other alcohols, but the grade of these alcohols is unknown. Avoid the use of rubbing alcohol from the drug store or pharmacy. Although this is isopropyl alcohol, it has additives that can leave residue on the heads and in the tape path.

When selecting wipers, be sure they are designated as clean room, non-residue, and lint free.

Head stains are thin films of material that are chemically bonded to the head and will not come off with solvents. The only way to remove them is to cut through them using head cleaning tape. These stains can be polymers and/or metallic.

3 Sources of Supply

The recommended cleaners are pure chemicals and may be purchased from any chemical supplier. ACS grade should be specified. Table 3 lists catalog numbers from Aldrich and Fisher Scientific as examples.

The supply description for ordering TexWipes is: TexWipe TX304, 4-inch x 4-inch. 100% Cotton, No chemical Additives, Antistatic Characteristics, Cleanroom Packaged. 300 pieces/bag. Available from many scientific supply catalogs. Example: Scientific Products Division (Baxter). Catalog # C6415-11 (1200 ct.) or #C6417-78 (300 ct.). [7].

Although latex gloves will protect against the alcohols, xylene will permeate and/or deteriorate them. The only thin glove that NML has been able to identify for use with xylene at this time is Best brand N-DEX^{reg} Powder Free 6-mil Nitrile gloves. 8-mil gloves give more protection, but they are not available in Powder-Free and are less sensitive for delicate operations such as scanner cleaning. The N-DEX literature indicates that 6-mil gloves are not good for total immersion in xylenes, but they are good for one splash per minute, up to 100 minutes. The NML recommends that you obtain the N-DEX literature [8] and follow their recommendations. These gloves can be purchased from Fisher Scientific, VWR Scientific and other general science supply catalogs. The unpowdered gloves are:

N-DEX Catalog No.:

Extra Small 9005PFXS

Small 9005PFS

Medium 9005PFM

Large 9005PFL

Extra Large 9005PFXL

Name	CAS Registry	Grade	Fisher** 1-800-766-7000	Aldrich** 1-800-558-9160
Methyl Alcohol	67-56-1	Certified ACS	A412-1	17,933-7
Isopropyl Alcohol	67-63-0	Certified ACS	A416-1	19,076-4
Xylenes***	1330-20-7	Certified ACS	X5-1	32,057-9

* CAS is the number assigned by the Chemical Abstracts Service to identify a chemical. This number will specify the proper chemical to any supplier.

** These numbers are for 1 liter bottles. To order larger quantities, see catalog or discuss with vendor's customer service representative.

***This reagent is generally a mixture of the ortho, meta, and para isomers and may contain some ethyl benzene.

Table 3. Sample Catalog Numbers . Sample Catalog Numbers for these Chemicals are from Aldrich and Fisher Scientific. These chemicals can be purchased from most chemical suppliers

4 References

1. **Care and Handling of Computer Magnetic Storage Media**, National Bureau of Standards Special Publication 500-101, U. S. Department of Commerce, Washington, D. C., 1983.
2. **VPR-300 Series Video Production Recorder**, Service, Volume II, Ampex Corporation, Redwood City, CA, 1989.
3. N. Irving Sax and Richard J. Lewis, Sr., **Dangerous Properties of Industrial Materials**, seventh edition, Van Nostrand Reinhold, New York.

4. **Materials Safety Data Sheet Database**, Occupational Health Services, Inc., New York.
5. **The Fisher Catalog**, Fisher Scientific, Pittsburgh, PA, 1992.
6. **The Aldrich Catalog**, Aldrich, Milwaukee, WI.
7. **Scientific Products General Catalog**, Baxter Diagnostics Inc., Scientific Products Division, 1430 Waukegan Road, McGaw Park, IL 60085-6787.
8. **Intermittent Chemical Exposure Guide for Best N-Dex Nitrile Gloves**, Best Manufacturing Company, Edison Street, Menlo, Georgia 30731.

Trademarks

TexWipe is a registered trade mark of the Texwipe Company.

N-DEX is a registered trade mark of Best Manufacturing company.