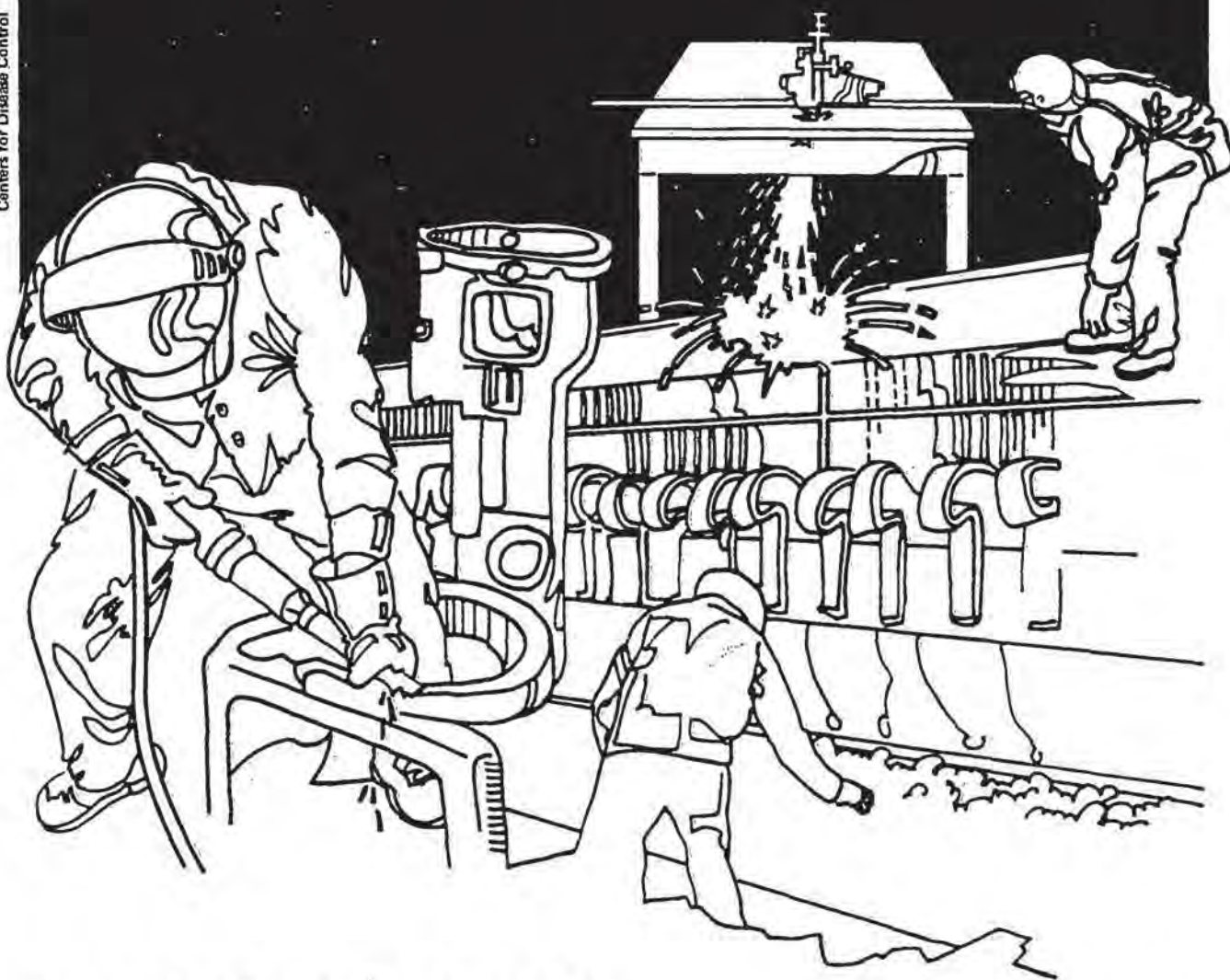


NIOSH



Health Hazard Evaluation Report

HETA 31-305-961
AURORA SCHOOLS
AURORA, COLORADO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 81-305-961
OCTOBER 1981
AURORA SCHOOLS
AURORA, COLORADO

NIOSH INVESTIGATORS:
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I. SUMMARY

At the request of the Aurora Schools, Aurora, Colorado, an environmental evaluation was conducted at the East Middle School-Aurora School District by the National Institute for Occupational Safety and Health (NIOSH) on June 19, 1981. The request concerned the potential exposure to teacher aides from methyl alcohol (methanol) during the use of spirit duplicators. There are four spirit duplicators used by the teacher aides at the East Middle School. The duplicating fluids were found to consist of 84% methanol for the Type II-DLI, Inc. and 81% methanol for the Klean Write solution.

A total of three personal samples and three area samples were collected for 15, 35, and 45 minute periods. Two additional instruments were also used during the survey to give immediate results on methanol exposures in the work area and breathing zone.

In each of the sampling methods used, significant exposure levels above the Occupational Safety and Health Administration Time Weighted Average (OSHA - TWA) standard (260 mg/M³) and the NIOSH recommended level of 1047 mg/M³ for a 15 minute sampling period were found. These levels ranged from 396.0 to 640.0 mg/M³ for the TWA and 968.0 to 1400.0 mg/M³ for the 15 minute sampling period. There were no exhaust ventilation systems used on these duplicating machines.

The results of the medical questionnaire showed that all of the teacher aides experienced some adverse health symptoms, e.g., blurred vision, headaches, burning of the nose, sluggishness, dizziness, sore throat, dermatitis, chest tightness, and depression. The majority of these symptoms are characteristic of toxic exposure to methyl alcohol.

On the basis of the environmental and medical data, NIOSH determined that a health hazard from excessive methyl alcohol existed to the teacher aides at the East Middle School, Aurora, Colorado. This exposure exists to those operating the duplicator, as well as those persons present in the room while this process is in operation. Recommendations on eliminating or controlling the health hazard at this work site are included in this report.

KEYWORDS: SIC 8211 (Elementary and Secondary Schools), teacher aides, methyl alcohol, methanol, spirit duplicators.

II. INTRODUCTION

NIOSH received a request in May 1981 from the Aurora Schools, Aurora, Colorado, to determine if there was a health hazard from excessive levels of methyl alcohol (methanol) to teacher aides at the district's East Middle School who operate spirit duplicators. An environmental survey was conducted on June 19, 1981, and the environmental data, as well as conclusions and recommendations, were sent to all concerned parties on July 16, 1981.

III. BACKGROUND

A "spirit duplicator" is a machine that uses methyl alcohol, or spirits, to reproduce printed material. The process consists of taking a master copy with a reverse image printed on it in an alcohol soluble dye and placing it on the drum of the duplicator. The paper to be printed is fed under and in contact with a wick that is saturated with methyl alcohol. A thin layer of alcohol is laid on the paper. As the alcohol-wetted paper comes in contact with the master copy, the alcohol dissolves a small portion of the dye and transfers the image to the finished sheet. The evaporated methyl alcohol may result in an inhalation exposure to the operator. When the duplicated papers are stacked the methyl alcohol slowly evaporates. Methyl alcohol evaporates at a faster rate when each sheet of paper is exposed to the air, such as during collating and stapling.

The amount of time a teacher aide spends duplicating varies from day to day. For example, an aide may spend two to three hours a day, four days a week duplicating, then on the fifth day spend four to five hours. Others may spend four to six hours a day. Hence, it is not easy to characterize a typical work day but a typical work week may be described.

Exposure of teacher aides is also likely to have occurred as a result of skin absorption during the handling of paper wet with methyl alcohol or washing hands with methyl alcohol. Some aides wore rubber gloves.

The duplicators at this school had no local or general mechanical exhaust.

IV. ENVIRONMENTAL DESIGN AND METHODS

1. Environmental

Breathing zone and area samples were collected for methyl alcohol vapors over 15, 35, and 45 minute sampling periods. Because the exposure time varies from day to day, 15-minute samples were collected to indicate the potential exposure while operating the duplicator and to determine if the methyl alcohol concentrations exceeded the NIOSH 15-minute recommended exposure level.

Personal breathing zone air samples were collected on silica gel tubes using low flow pumps. The pumps drew air through the tube at a flow rate of 200 cubic centimeters (cc) per minute. The silica gel samples were analyzed by gas chromatography.

The breathing zone and area air concentrations were also measured using a Wilks Miran 103 gas analyzer, which was specific for methyl alcohol analysis, and colorimetric gas detection devices. The colorimetric method has an accuracy of plus or minus 35 percent at one-half the exposure limit and an accuracy of plus or minus 25 percent at one to five times the exposure limit.

2. Medical

A medical questionnaire was administered to the teacher aides.

V. EVALUATION CRITERIA

1. Environmental

The environmental evaluation criteria for methyl alcohol are the eight hour time-weighted average (TWA) of 200 ppm or 260 mg/M³ (OSHA standard) and the short term exposure level for any 15 minute period of 800 ppm or 1047 mg/M³ (NIOSH recommended level).

2. Toxicological

The two most common routes of occupational exposure to methyl alcohol are inhalation and absorption through the skin. Signs and symptoms of methyl alcohol intoxication include headache; dizziness; nausea; vomiting; weakness; vertigo; chills; shooting pains in the lower extremities; unsteady gait; dermatitis; multiple neuritis characterized by paresthesia; numbness; prickling and shooting pain in the back of the hands and forearms, as well as edema of the arms; nervousness; gastric pain; insomnia; blurred vision; general visual disturbances; blindness and acidosis (metabolic disturbance).

Methyl alcohol is not known to be a liver toxin in humans; however, there have been no long-term epidemiologic studies of chronic, low-level occupational exposure. There have been a few older animal studies where autopsy revealed deterioration of basic liver tissue (parenchymatous degeneration) proceeding, in the more severe cases, to focal necrosis (localized areas of tissue death). It is difficult to interpret these reports of liver toxicity in animals which were done in the early 1900's. The data is presented summarily and not in sufficient detail for careful evaluation. In general, the animal data is inconclusive. It is reported that primates and non-primates metabolize methyl alcohol differently, and the importance of this difference is not well known.

There have been autopsy reports of pancreatic necrosis in humans after acute ingestion of methyl alcohol. As with liver toxicity, the pancreatic pathology in humans is not specific, and chronic ethanol intake is usually an important confounding and likely causative factor.

VI. RESULTS AND DISCUSSION

1. Environmental

Analysis of the two duplicating fluids used at the school were found to consist of 84% methanol for Type II - DLI, Inc. and 81% methanol for Klean Write solution.

Methyl alcohol concentrations were measured in the breathing zone of one teacher aide and at various locations in the room while duplicating operations were in progress. Measurements were made in only one room at the school and involved only one of the four duplicators used at this school. The reason only one room and one machine were evaluated was that the survey was performed during summer recess and the requestor was concerned about instituting engineering changes as soon as possible if overexposures were detected.

Personal and area sample results are shown in Table I. The area sample results ranged from 396.0 - 550.0 mg/M³ for a 45 minute sampling period. The personal sample results ranged from 969.0 - 1400.0 mg/M³ for 15 minute sampling periods. As noted in Table I, the lowest personal methyl alcohol exposure occurred during the first 15 minutes of the duplicating operation and for each additional 15 minute sampling period the exposure levels increased significantly. This increase was also noted when we sampled with the other two sampling techniques. That is, when we initially sampled with the Wilks Miran we found levels from 200-300 ppm. After 10 minutes of duplicating the concentration detected on the Wilks exceeded the detection capabilities (300 ppm) of this detection method. This increase was also noted when the colorimetric sampling method was used.

2. Medical

Each of the teacher aides gave medical histories. The results showed that all of the aides experienced some adverse health symptoms, e.g., blurred vision, headaches, burning of the nose, sluggishness, dizziness, sore throat, dermatitis, chest tightness, and depression. All of the aides felt that the symptoms occurred while either performing the duplicating operation or while in the room where duplicating was or had been performed. Each felt that their symptoms subsided after leaving the exposure area and especially during the weekend or holidays.

This medical data indicate that the teacher aides had symptoms suggestive of methyl alcohol toxicity.

VII. CONCLUSIONS

1. All of the samples taken during the survey period indicate that excessive exposure levels to methyl alcohol did exist and would exist in the future when the duplicating operation is in progress.
2. Work practices, such as collating and stapling of freshly duplicated papers, as well as washing hands with methyl alcohol, will result in additional exposures.
3. A variety of adverse health effects consistent with methyl alcohol toxicity were observed in teacher aides and the prevalence of such effects appear to increase with the amount of time spent at the duplicating machine or while in the room where this process is in operation.

4. The likelihood of similar overexposures in other areas where duplicating is performed is very high. This condition not only would exist in other rooms at the East Middle School, but also in other schools in the Aurora School District that use spirit duplicators.
5. Simple engineering controls are available to control these exposures (refer to Figures 1-3).

VIII. RECOMMENDATIONS

In view of the findings of NIOSH's environmental study, as well as personal communications with individuals in the school system, the following recommendations are made to provide a better work environment for the concerned employees:

1. Provide local exhaust ventilation (see drawings Figures 1, 2, and 3) on "spirit duplicators" unless measured air concentrations for the duplicator fluids indicate ventilation is not necessary.
2. Prevent re-entry of exhausted vapors through nearby open windows or doors.
3. Allow duplicated paper to "air" for 24 hours before collating and stapling.
4. Do not wash hands with the duplicator fluids to remove inks from the hands. Use soap and water or a waterless hand cleaner.
5. Provide rubber gloves for those individuals who handle papers.
6. Once exhaust engineering controls have been instituted for the machine evaluated in this survey, a re-evaluation should be performed to assure that the new exhaust system is performing properly, i.e., reducing the exposure below the criteria established for this survey.
7. It would be prudent for the Aurora School System to evaluate other schools in their district where spirit duplicators are used and, if necessary, institute exhaust ventilation as recommended.

IX. REFERENCES

1. National Institute for Occupational Safety and Health Technical Assistance Report (TA 80-32), June 1980.
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5. Criteria for a Recommended Standard...Occupational Exposure to Methyl Alcohol, U.S. Department of Health, Education, and Welfare, Public Health Service (NIOSH) Publication No. 76-148.
6. Tyson, H.H., Schoenberg, M.J., J. Am Med Association 63:915, 1914.
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XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Aurora Schools.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado State Department of Health.
5. State Designated Agency.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

METHYL ALCOHOL CONCENTRATIONS

Aurora Schools
Aurora, Colorado

June 19, 1981

<u>Sample Type</u>	<u>Sample Number</u>	<u>Sampling Time (minutes)</u>	<u>Sample Results (mg/M³)</u>
Area/Desk-west side	51	45	416.0
Area/Desk-south side	52	45	396.0
Area/Book Shelf	53	45	550.0
Personal/Operator	54	35	640.0
Personal/Operator	55	15	969.0
Personal/Operator	56	15	1080.0
Personal/Operator	57	15	1400.0

ENVIRONMENTAL CRITERIA: OSHA (TWA) 260 mg/M³
NIOSH (C) 1047 mg/M³

mg/M³ = milligrams of sample per cubic meter of air.

TWA = 8-hour, time-weighted average.

C = Ceiling which should not be exceeded within any 15 minute period.

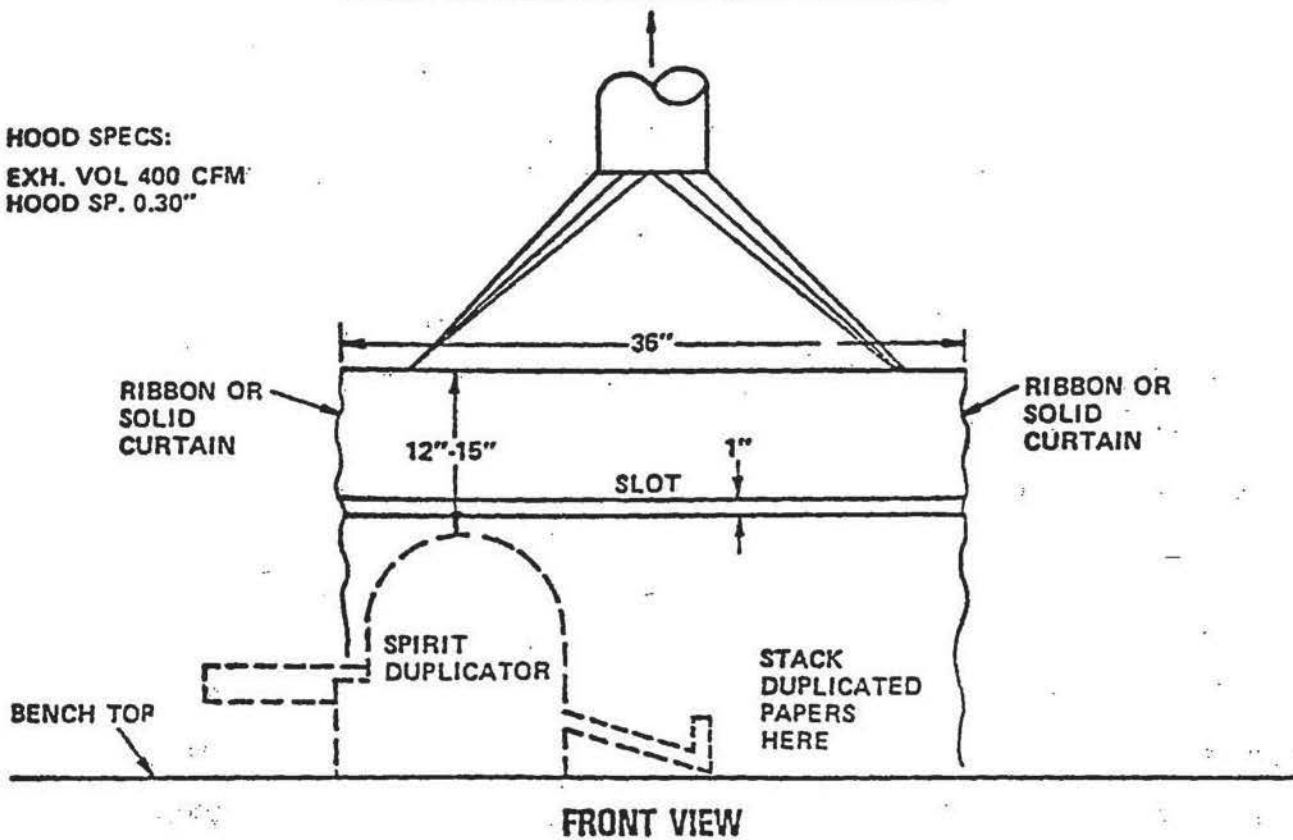
FIGURE 1

"DUPLICATING MACHINE EXHAUST"

—PREFERRED METHOD—
GOOD ENCLOSURE WITH SLOT EXHAUST

HOOD SPECS:

EXH. VOL 400 CFM
HOOD SP. 0.30"



NOTE:

- ADD HOOD SP. TO SYSTEM SP. FOR FAN SIZE
EXH. TAKE OFF CAN BE DOWN.
- PROVIDE FOR MAKE-UP AIR
EG. VENT IN DOOR
- LOCAL CODES MAY PROHIBIT EXHAUSTING THROUGH WINDOW PANES

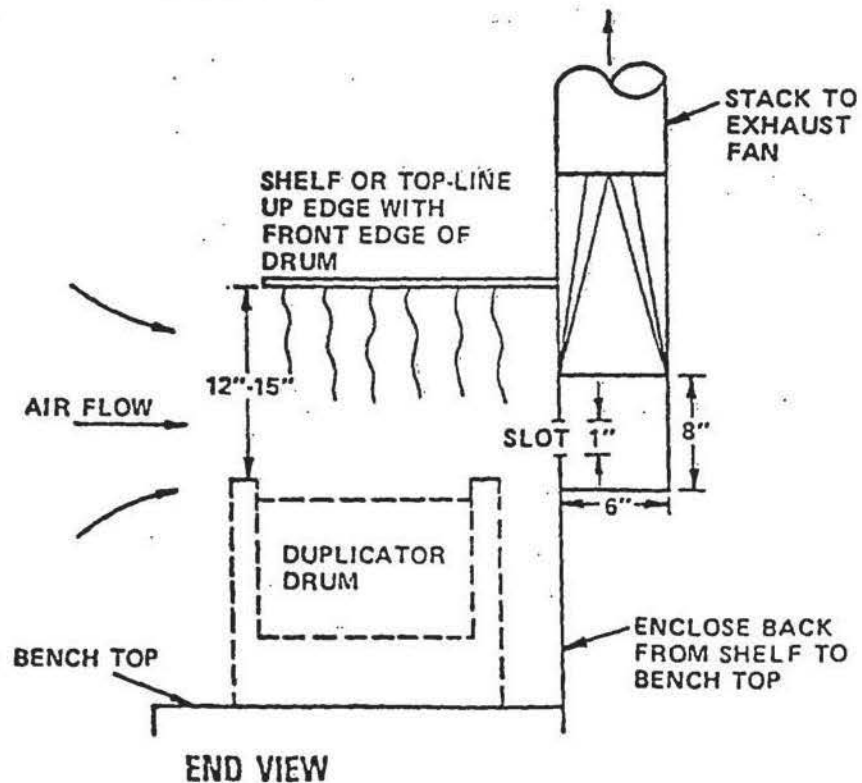
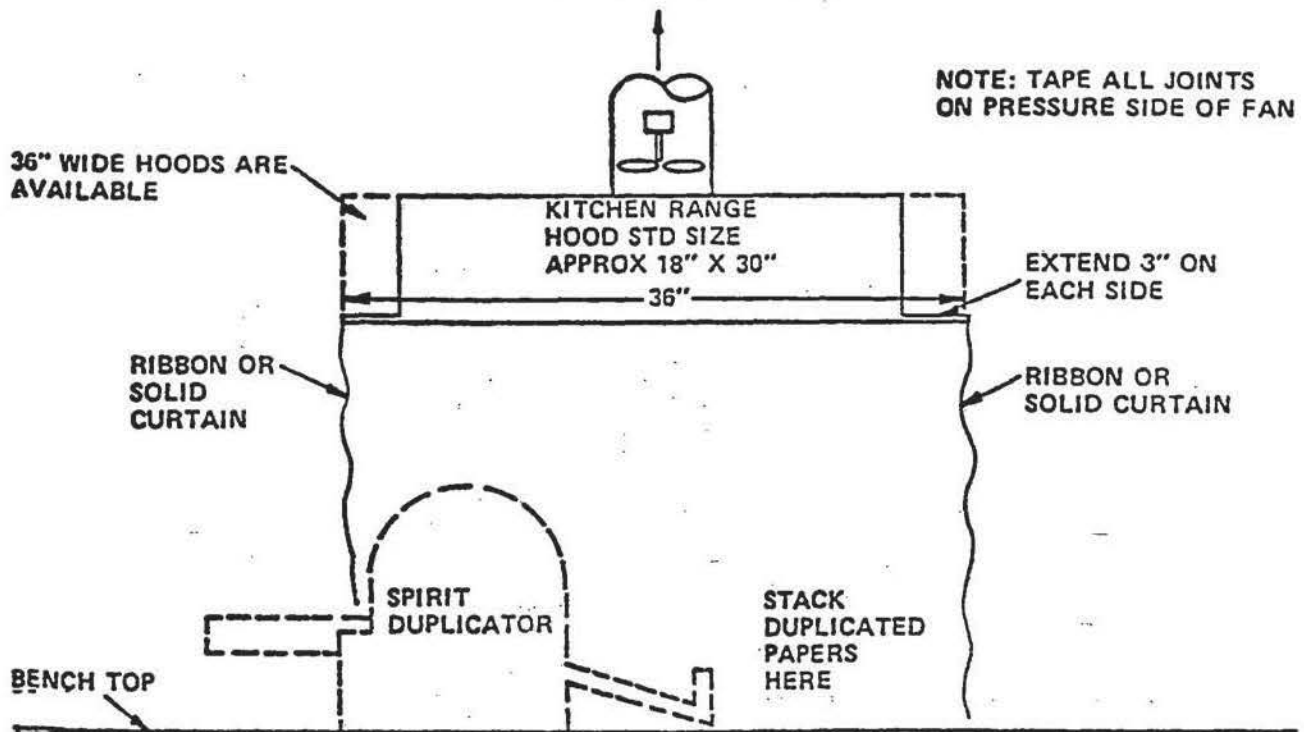


FIGURE 2

"DUPLICATING MACHINE EXHAUST"

-ALTERNATE METHOD-
KITCHEN RANGE TYPE HOOD
WITH GOOD ENCLOSURE



FRONT VIEW

EXH. VOL
400 CFM
MINIMUM

NOTES:
-PROVIDE FOR MAKE-UP AIR EG. VENTS IN DOOR
-LOCAL CODES MAY PROHIBIT EXHAUSTING THROUGH WINDOW PANES

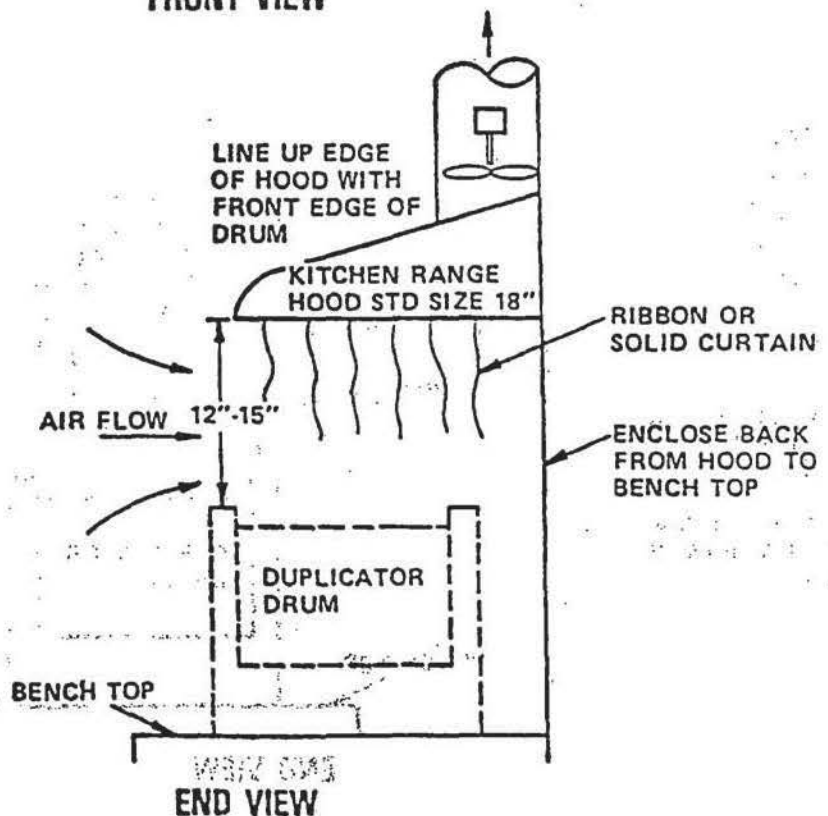
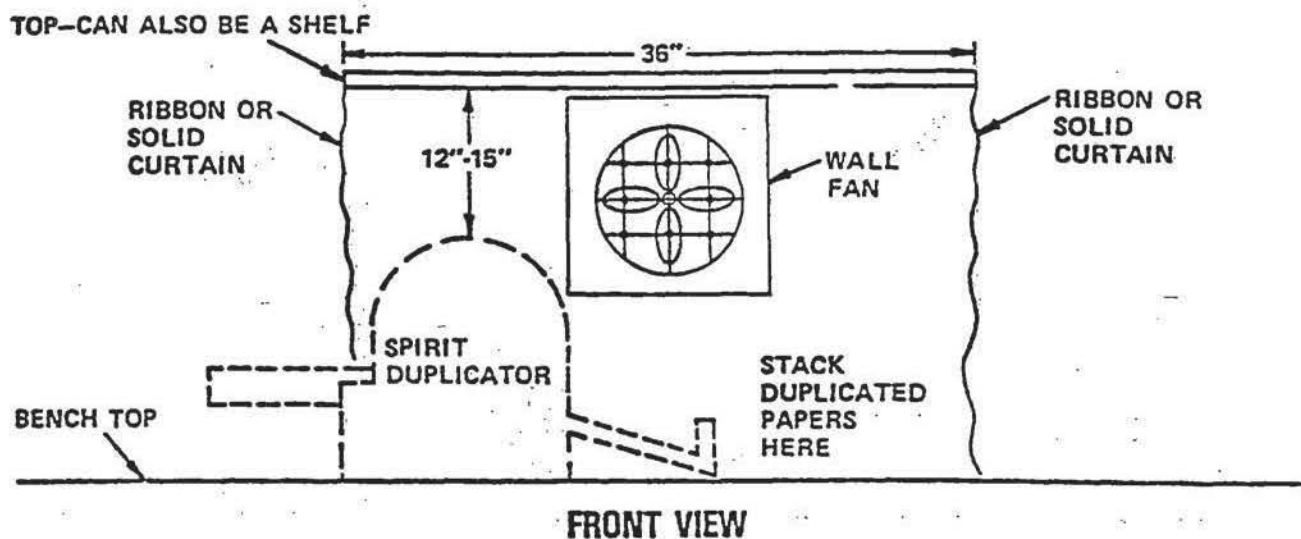


FIGURE 3

"DUPLICATING MACHINE EXHAUST"

-ALTERNATE METHOD-
WALL FAN WITH GOOD ENCLOSURE



EXH FAN:
WALL TYPE
WITH AUTO-
SHUTTER
400 CFM
MINIMUM

NOTE:

- LOCAL CODES MAY PROHIBIT WINDOW MOUNT
- PROVIDE FOR MAKE-UP AIR EG. VENTS IN DOOR

