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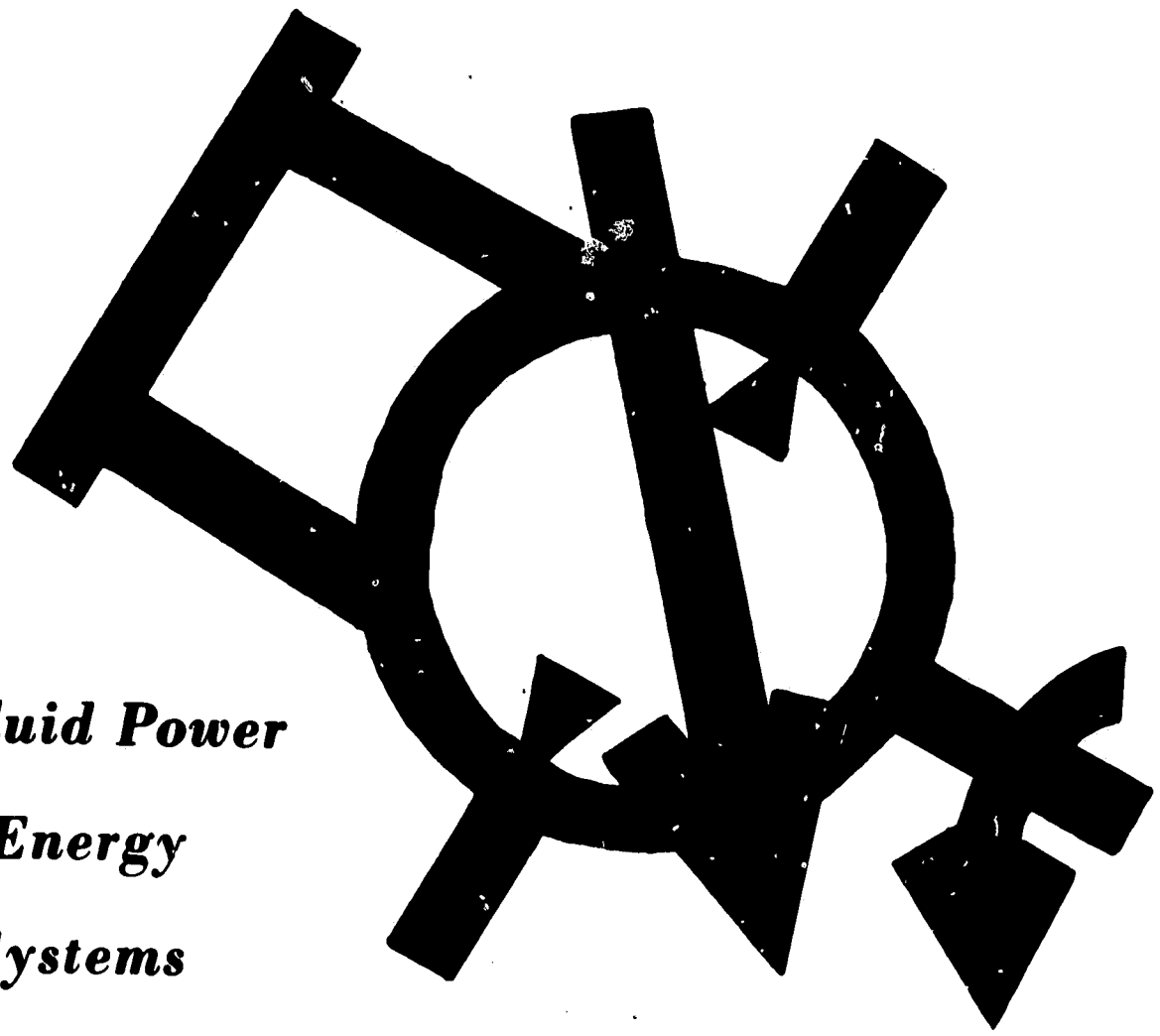
This course outline was developed by industrial arts teachers during the 1968 National Defense Education Act summer institute. It is intended for the specific use of teachers involved in fluid power courses. A topical outline covers terminology, equipment, procedures, and safety techniques. Other sections include a book list, a book evaluation form, an audiovisual materials list, and floor plans for school laboratories. The appendix includes a participant list. The final report of the institute is available as VT 008 185. (EM)

NDEA INSTITUTE FOR ADVANCED STUDY IN INDUSTRIAL ARTS



Integration of Fluid Power Instruction Into Energy and Propulsion Systems

SIX WEEKS JUNE 24 TO AUGUST 2, 1968

WAYNE STATE UNIVERSITY
DETROIT, MICHIGAN 48202

IN COOPERATION WITH THE U.S. OFFICE OF EDUCATION,
AS AUTHORIZED UNDER TITLE XI OF THE NDEA, AS AMENDED

COURSE OUTLINE AND RESOURCE MATERIALS FOR FLUID POWER INSTRUCTION IN SECONDARY SCHOOLS

Prepared at The

NDEA SUMMER INSTITUTE
June 24 - August 2, 1968

Prepared By:

THE NDEA PARTICIPANTS

Under the Direction of:

William D. Wolansky

And

Leslie H. Cochran

WAYNE STATE UNIVERSITY
DEPARTMENT OF INDUSTRIAL EDUCATION
Detroit, Michigan 48202

ACKNOWLEDGEMENTS

Through the combined efforts of the Project Staff this 1968 Summer Institute was a worthwhile and successful program. It is hoped that the continuation and extension of similar institutes will be brought about by the marked success of this one. The experience and knowledge of the following personnel connected with this program contributed to its success.

Dr. G. Harold Silvius,
Director

Leslie H. Cochran,
Associate Director

Dr. William D. Wolansky,
Instructor

John Nagohosian,
Instructor

William F. Gayde,
Instructor

Kenneth McLea,
Industrial Coordinator

Credit is also extended to the participating industries and resource personnel that contributed to the success of this Institute. These include:

Chrysler Corporation
P. O. Box 118
Detroit, Michigan 48231

Detroit Diesel Engine Plant
13400 West Outer Drive
Detroit, Michigan 48239

Ford Motor Company
Rouge Engine Assembly Plant
3001 Miller Road
Dearborn, Michigan 48210

Ford Motor Company
Sterling Plant
39000 Mound Road
Warren, Michigan 48092

Scott Engineering
1400 S.W. 8th Street
Pompano Beach, Florida 33060

Joseph Lamb Company
5663 East Nine Mile Road
Detroit, Michigan 48220

MacValves Inc.
13200 Capital
Oak Park, Michigan 48237

Pontiac Motors Co.
Assembly Plants and Training School
Pontiac, Michigan 48053

Rosaen Filter Company
1776 East Nine Mile Road
Hazel Park, Michigan 48220

Technical Education and Manufacturing Inc.
161 Vester
Ferndale, Michigan 48220

Vickers A & E Center
and Hydraulics Training School
Troy, Michigan 48202

FOREWORD

The Summer Institutes have as their primary objective to update the technical and professional competencies of practicing teachers. The 1968 Summer NDEA Institute in industrial education at Wayne State University had as its central purpose the "Integration of Fluid Power Instruction Into Energy and Propulsion Systems." Specifically, the program was designed to strengthen the teacher's background in fluid power technology through:

1) Technical instruction covering the content of fluid power as it relates to energy and propulsion.
2) Directed field experiences with local industries.
3) Teaching strategies directed at the development, the evaluation, and the utilization of instructional materials.

The participants in this Institute were selected from secondary schools and teacher education programs, and represented thirteen states. They were teaching in the Power Technology area previous to their coming to WSU.

To assist the teachers to infuse fluid power into their existing power programs, a series of professional seminars were conducted. As a result of their technical instruction, field experiences, and laboratory activities it was possible for them to develop instructional materials for their own classroom situations.

During the seminar the participants worked in small groups giving attention to such aspects as objectives, course content, instructional resources, and laboratory layouts. The materials developed and contained in this brochure are the products of these twenty-four teachers, and represent their insights and experiences.

NDEA Staff

TABLE OF CONTENTS

INTRODUCTION

The purpose of this fluid power course outline is to serve as a guide for introducing basic fundamentals necessary for entry into the field of fluid power and related curricula. All students entering the comprehensive high school, as well as technical and vocational high schools, should have the opportunity to study and experience this new instructional area of fluid power. They should then have an opportunity to discover firsthand the significance and vocational implications of this curriculum area. It will also permit students to discover the interrelatedness of fluid power with other energy sources.

This course outline was developed by practicing teachers during the 1968 Summer NDEA Institute at Wayne State University through the combined efforts of the participants and staff. It is intended for the specific use of teachers involved and interested in fluid power laboratory and classroom instruction. This outline is a tentative guide and should be used accordingly. It is hoped, however that it will facilitate the teaching and preparation of students in this area of education. Its intent was also to provide added information and direction to the experienced teacher as well as the new and inexperienced teachers entering this field.

OBJECTIVES

This course outline was designed to provide the student with a background of the terminology, equipment, procedures, and safety techniques used in the fluid power industries.

The general objectives are directed at helping the student to:

1) Develop an understanding and appreciation of fluid power as it applies to industry and everyday living.

2) Acquire an understanding of the basic physical laws as applied to energy, fluid mechanics, and related materials.

3) Become involved in meaningful activities and problems that are designed to be solved through the fundamentals of fluid power laboratory instruction.

4) Acquire a command of the basic communication skills in fluid power technology.

5) Acquire a sensitivity to the importance of fluid power as it contributes to man's utilization of the total energy sources.

In order to realize the general objectives above, the student will be expected to attain these outcomes:

1) Be able to explain the basic fluid power principles.

2) Be able to demonstrate his proficiency in the basic application of fluid power components and systems.

3) Be able to interpret basic terminology of the fluid power industry.

4) Be able to identify the basic components used in the fluid power industry and explain the function of these components.

5) Be able to apply proper safety precautions, to safeguard himself and others.

INTRODUCTION TO FLUID POWER

Unit 1 - Orientation

A. Classroom Presentation
   1. Overview
   2. Classroom Orientation
   3. Rules of Conduct in Classroom
   4. Safety Instruction

B. Laboratory Activities
   1. Safety Instruction
   2. Laboratory Orientation
   3. Rules of Conduct in Laboratory

4. Locker Assignments
5. Duty Assignments
6. Station Assignments

C. Related and Instructional Information
1. Occupational Information
a. Types of Occupations
b. Frequency of Opportunities
c. Places of Employment

Unit 2 - Basis and History of Fluid Power

A. Classroom Presentation
1. Historical Applications
2. Contemporary Uses
3. Occupational Information
4. Potential Applications

B. Laboratory Activities
1. Hydraulic Actuated Devices
a. Cylinders
b. Pumps
c. Motors
2. Pneumatic Actuated Devices
a. Cylinders
b. Motors
c. Compressors
3. Combination Devices
a. Accumulator
b. Intensifiers

C. Related and Instructional Information
1. Interview
a. Industrial Representatives
b. Fluid Power Society
2. Guest Speakers
3. School Demonstrations

Unit 3 - Introduction to Fluid Power and Formulas

A. Classroom Presentation
1. Pascal's Law
2. Gas Laws
a. Charles' Law
b. Boyle's Law
3. Other Related Laws and Formulas

B. Laboratory Activities
1. Cylinder Demonstrations with Pascal's Law
2. Working with Pump Mock-ups
3. Use of Gauges to illustrate practical application of Gas Laws

C. Related and Instructional Information
   1. Analysis Form
   2. Reference Books
   3. Reference Materials

Unit 4 - Circuitry Application

A. Classroom Presentation
   1. Cut-a-way Diagrams
   2. Graphic Diagrams
   3. Graphic Symbols

B. Laboratory Activities
   1. Setting up Working Circuits
      a. Cycle One Cylinder
      b. Sequence Two Cylinder
      c. Cycle One Cylinder with One Direction Speed Control
      d. Other Selected Circuits

C. Related and Instructional Information
   1. Films and Film Strips
   2. Slides and Transparencies
   3. Cut-a-ways
   4. Working Transparencies and Models

Unit 5 - Medium of Power Transmission

A. Classroom Presentation
   1. Types
   2. Uses
   3. Additives
   4. Specifications

B. Laboratory Activities
   1. Observe Fluid Characteristics
   2. Samples of Oil
   3. Viscosity Tests
   4. Compressibility

C. Related and Instructional Information
   1. Components
   2. Models
   3. Cut-a-ways

Unit 6 - Components of Fluid Power

A. Classroom Presentation
   1. Reservoirs - strainers - filters
   2. Cylinders
   3. Pumps
      a. Positive and non-positive
      b. Design types
   4. Motors
      a. Positive and non-positive
      b. Design types
   5. Hoses - tubing - pipe
      a. Types
      b. Applications
      c. Fittings
      d. Flow characteristics
   6. Valves
      a. Types
      b. Applications
   7. Instrumentation
      a. Flow
      b. Pressure
      c. Torque
      d. Power
      e. Vacuum
   8. Accumulators
      a. Types
      b. Applications
   9. Intensifiers - Boosters

B. Laboratory Activities
   1. Identification
   2. Disassembly and Assembly
   3. Testing

C. Related and Instructional Information
   1. Hydraulic Equipment Manufacturers
   2. Industrial Applications
   3. Field Applications

Recommended Time Allotments
For a One Semester Course in Fluid Power

Unit Number	Hours in Laboratory	Hours in Classroom
Unit I	2	2
Unit II	2	2
Unit III	5	5

Unit Number	Hours in Laboratory	Hours in Classroom
Unit IV	5	5
Unit V	5	5
Unit VI	29	18
Field Trips	5	
Total	53	37

90 Sessions
1 Semester

TEXT EVALUATION

During the 1968 Summer NDEA Institute in Fluid Power--attended by 24 teachers from all parts of the country---a committee of four was formed and charged with the responsibility of selecting a text and other reference materials for a secondary school course in fluid power. Because of changes in terminology and recent developments in the field of fluid power, it was decided by the committee to evaluate only those publications printed from 1960 to the present time (1968).

The first problem confronting the committee was the development of criteria as a basis for meaningful evaluation. Using suggestions made by Dr. G. Harold Silvius and Dr. William D. Wolansky, the committee developed the analysis form that is included in this section.

The committee concluded that the material currently available in the form of textbooks which were reviewed by the committee were primarily intended for use in engineering, maintenance, and related areas. These books were not intended for basic and general informative use.

The main problems encountered in the use of these books at a secondary

school level are as follows:

1) Much of the background needed for a thorough understanding of the presented material was not included in the book.
2) The terminology and symbols used in the book were either obsolete or too technical to be used without detailed explanations. These explanations were often not included in the publication.
3) The style or method of presenting the material was lacking in illustrations and related examples to bring across the author's ideas.

At the present time the committee recommends that the following books (listed on pages 11 and 12) could be used in a form of reference books, but none of these books should be used as a text. The committee also recommends that material which is available in the form of pamphlets, charts, calculators, filmstrips, and instructor-prepared information sheets could be used as the main source of material for presenting a course in fluid power.

It is hoped that a publication will soon be available that will better fit the needs of a program presented at the secondary school level in fluid power.

The instrument developed for textbook analysis was used to evaluate the suitability of recent reference sources, and is included.

WAYNE STATE UNIVERSITY

Department of Industrial Education

BOOK ANALYSIS

	A	B	C	D	
1) Is the level of instructional material appropriate for intended use?					1
2) Is the book written at a suitable readability level?					2
3) Is the book written in a style that generates interest on the part of the reader?					3
4) Does the book, chapter, and/or unit follow a logical sequence and development of technical content?					4
5) Are there adequate easily understood illustrations?					5
6) Do the illustrations clarify or reinforce technical content or procedure?					6
7) Are difficult theoretical concepts simplified by analogy and comparison?					7
8) Does the author define a new term when he first uses it and repeats it to reinforce technical vocabulary?					8
9) Does the author summarize the key points made in the unit?					9
10) Does the author include related and occupational information?					10
11) Does the book list test questions and problems at the end of each chapter and unit?					11
12) Does the book include assignments or experiments to be performed by the student?					12
13) Are safety precautions stressed?					13
14) Does the book contain bibliographies?					14
15) Does the book list films, slides, and other teaching aids?					15

CODE:
(-) Does not apply to this book.
(0) Not included in this book.
(1) Inadequate.
(2) Adequate
(3) Highly satisfactory.

BOOKS REVIEWED

A.

TITLE: _____ AUTHOR: _____ COST:$_____

QUALIFICATIONS OF AUTHOR: _____

_____

_____

PUBLISHER: _____ DATE: _____

COMMENTS & RECOMMENDATIONS: _____

_____

_____

B.

TITLE: _____ AUTHOR: _____ COST:$_____

QUALIFICATIONS OF AUTHOR: _____

_____

_____

PUBLISHER: _____ DATE: _____

COMMENTS & RECOMMENDATIONS: _____

_____

_____

C.

TITLE: _____ AUTHOR: _____ COST:$_____

QUALIFICATIONS OF AUTHOR: _____

_____

_____

PUBLISHER: _____ DATE: _____

PERIODICALS

Fluid Power Handbook,
The Industrial Publishing Corporation
812 Huron Road
Cleveland, Ohio 44115

Fluid Power International,
John Trundell,
Eversholt Street
London, N.W. 1, England

Hydraulics and Pneumatics Magazine,
Industrial Publishing Company
Penton Building
Cleveland, Ohio 44113

OTHER SOURCES

Basic Hydraulics. NAVPERS 16193. Washington, D.C.: U.S. Navy, Superintendent of Documents.

Basic Instrumentation for Fluid Power Systems, Henke and Johnson. Cleveland Ohio: Penton Publishing Company.

Fact Book. Minneapolis, Minnesota: Minnesota Rubber Company.

Filtration for Hydraulic Fluid Power Systems, Technical Manual T3 10.65.2 Hazel Park, Michigan: Rosaen Filter Company.

Fluid Power Book: Machine Design. Cleveland Ohio: Penton Publishing Company.

Fluid Power, An outline prepared by participants in the 1964 Wayne State University Institute. Available from Fluid Power Society, Box 49, Thiensville, Wisconsin, Free.

Fluid Power Control. New York: John Wiley and Sons, Inc. 1960.

Fluid Power Data and Tables. Milwaukee, Wisconsin: The Oilgear Company.

Fluid Power Handbook and Directory. Cleveland, Ohio: Industrial Publishing Corporation.

Fluid Power Seals Technical Papers. Chicago, Illinois: Chicago Rawhide Company.

Glossary of Terms for Fluid Power: ASA 93.2-1965: Thiensville, Wisconsin: National Fluid Power Association.

How Fluid Power Serves. Thiensville, Wisconsin: National Fluid Power Association.

Hydraulic Circuit Selector Handbook. Akron, Ohio: Bellows-Valvair, 1965, Free.

Hydraulic Controls on Machine Tools. Flint, Michigan: General Motors Institute.

Hydraulic Oil and their Application. Sun Oil Co. Technical Bulletin, B-4: Sun Oil Company.

Hydraulic Systems for Industrial Machines. New York: Mobile Oil Company.

Operation and Care of Hydraulic Machines. New York: The Texaco Company.

Practical Hydraulics. Troy, Michigan: Vickers Incorporated.

REFERENCE BOOKS

Basic Hydraulics. (Navpers 16193-A) Washington D.C.: U.S. Government Printing Office, 1965.

Fluid Power in Plant and Field. Dallas, Texas: Womack Machine Supply Company, 1968.

Glenn, Harold T. Exploring Power Mechanics. Peoria, Illinois: Chas. A. Bennett Company Inc., 1967.

Hedges, Charles S. Industrial Fluid Power Text. Dallas, Texas: Womack Machine Supply Company, 1965.

Henke, Russell. Closing the Loop. Milwaukee: Milwaukee School of Engineering, 1966.

Hicks, Tyler G. and Pippenger, John J. Industrial Hydraulics. New York: McGraw-Hill Book Co., 1962.

Hydraulic Power Transmission. (Engineering Bulletin No. HP-221S) Chicago: American Oil Company, 1966.

Industrial Hydraulics Manual. (Vickers Inc.) Troy, Michigan: Sperry Rand Corporation, 1965.

Mobile Hydraulics Manual (Vickers Inc.) Troy, Michigan: Sperry Rand Corporation, 1966.

Stewart, Harry L. Audels Practical Guide to Fluid Power. Indianapolis: Theodore Audel and Co., 1966.

Stewart, Harry L. Hydraulic and Pneumatic Power for Production. New York: The Industrial Press, 1955.

Stewart, Harry L. and Storer, John M. Fluid Power. Indianapolis: Howard W. Sams and Co., Inc., 1968.

FLUIDICS REFERENCE MATERIAL

An Introduction to Fluid Technology. Minneapolis: Honeywell. 1967.

Fluidic Devices Systems. Corning Fluidic Devices. New York: Corning Glass Works.

Control System Components. Gibson, J. E. and Tutuer, F. B. New York: McGraw Hill, 1958.

Feedback Systems. Harris, L. Dale. New York: John Wiley and Sons Inc., 1961.

Graphic Symbols for Fluid Devices and Circuits. Thiensville, Wisconsin: The National Fluid Power Association, 1967.

Recommended Standards for Fluidic Devices. Thiensville, Wisconsin: The National Fluid Power Association, 1967.

AUDIO VISUAL MATERIALS

Films and Filmstrips

Films: (16MM)

1. Hydraulic Oil

   Texaco, Inc.
   125 East 42 Street
   New York, New York 10017

2. The Hidden Giant

   Vickers Inc.
   Administration and Engineering Center
   P.O. Box 302
   Troy, Michigan 48084

3. Controlled Power

Vickers, Inc.
Administration and Engineering Center
P. O. Box 302
Troy, Michigan 48084

4. Cavitation

Shell Oil Company
50 W. 50th Street
New York, New York 10020

5. Harnessing Liquids

Shell Oil Company
50 W. 50th Street
New York, New York 10020

6. Basic Hydraulics

United World Films
Gout Films Dept.
1445 Park Avenue
New York, New York 10029

7. Fluid Flow in Hydraulic Systems

United World Films
Gout Films Dept.
1445 Park Avenue
New York, New York 10029

8. Hydraulic Turret Traversing Mechanism

The Oilgear Company
1560 West Pierce Street
Milwaukee, Wisconsin 53204

9. Operation Pushbutton

Bellows Valvair
Attn: Sales Manager
222 W. Market Street
Akron, Ohio 44303

10. Denison Vane Pumps

Denison Division-Abex Corp.
Attn: Advertising Manager
1160 Dublin Road
Columbus, Ohio 43213

11. Design for Power

Denison Hydraulics Division-Abex Corp.
Attn: Advertising Manager
1160 Dublin Road
Columbus, Ohio 43212

12. Hydraulic Components

Denison Hydraulics Division-Abex Corp.
Attn: Advertising Manager
1160 Dublin Road
Columbus, Ohio 43212

13. Power Up

Denison Engineering Division-Abex Corp.
Box 713
Lima, Ohio 45802

14. Our Industrial Air Power

Quincy Compressor Company
Quincy, Illinois 62301

15. Basic Principles of Hydraulics

Jam Handy Organization
2821 S. Grand Blvd.
Detroit, Michigan 48212

FILMSTRIPS

1. Elements of Compressed Air

Parker-Hannifin Corporation
17325 Euclid Avenue
Cleveland, Ohio 44112

2. Elements of Hydraulics

Parker-Hannifin Corporation
17325 Euclid Avenue
Cleveland, Ohio 44112

3. Hydraulic Fittings

Parker-Hannifin Corporation
17325 Euclid Avenue
Cleveland, Ohio 44112

4. Pneumatic Circuitry

Parker-Hannifin Corporation
17325 Euclid Ave.
Cleveland, Ohio 44112

5. Introduction to Fluid Power

Miller Fluid Power Institute
Flick-Reedy Corporation
7N015 York Road
Bensenville, Illinois 50106

6. Cylinders

Miller Fluid Power Institute
Flick-Reedy Corporation
7N015 York Road
Bensenville, Illinois 50106

7. Air Valves and Penumatic Systems

Miller Fluid Power Institute
Flick-Reedy Corporation
7N015 York Road
Bensenville, Illinois 50106

8. Air - Oil Systems

Miller Fluid Power Institute
Flick-Reedy Corporation
7N015 York Road
Bensenville, Illinois 50106

9. Air - Oil Boosters

Miller Fluid Power Institute
Flick-Reedy Corporation
7N015 York Road
Bensenville, Illinois 50106

10. Air is Power with record disc and booklet

    Ross Operating Valve Company
    120 East Golden Gate Avenue
    Detroit, Michigan 48203

11. Air Control Techniques with Record disc and booklet

    Ross Operating Valve Company
    120 East Golden Gate Avenue
    Detroit, Michigan 48203

Transparencies available from the following companies:

1) McGraw-Hill, 330 W. 42nd, New York, New York 10036

2) McKnight and McKnight, Bloomington, Illinois 60601

3) 3M Company, Minneapolis, Minnesota 55402

4) Parker-Hannifin, 17325 Euclid Avenue, Cleveland, Ohio 44112

5) Racine Hydraulics & Machinery Inc., Racine, Wisconsin 53406

6) Howard Sams, Indianapolis, Indiana 44112

7) TEAM, Inc., Ferndale, Michigan 48220

8) Vickers Inc., Division of Sperry Rand Corporation, Maple and Crooks Roads, Troy, Michigan 48084

9) Vega Enterprises, Inc., Route 3, Box 30015, Decatur, Illinois 62526

10) Wilkerson Corporation, Englewood, New Jersey 07631

11) Womack Machine Supply Company, P.O. Box 35027, Dallas, Texas 75235

LABORATORY LAYOUT

The Institute committee on laboratory design for fluid power technology felt there was no single laboratory design adequate for instructional purposes, since the requirements of the various school districts and the depth of instruction would vary. With these points in mind a committee developed

three typical laboratory layouts. One allowing 50 square feet per student, the other two would have 100 square feet per student. It was the consensus of the committee that these plans be used only as an aid in planning a new laboratory, while keeping in mind the following points: portability of the equipment, flexibility of the facilities, and future growth in the technology.

Due to the nature of, and infinite number of different existing shops, the committee felt it would be beyond the scope of this publication to develop a layout that would be of assistance to every situation. Therefore, it was decided that the following list of items, if not already in the area to be converted, should be installed:

Electrical:

120-240 volt A.C. 3-phase
Overhead buss drop

Pneumatics:

Supply of air: Preferably piped in by locating compressor outside the laboratory.
Pneumatic trainer or equivalent.
Quick disconnect hose couplings.
Hose rack.
Assortment of components.

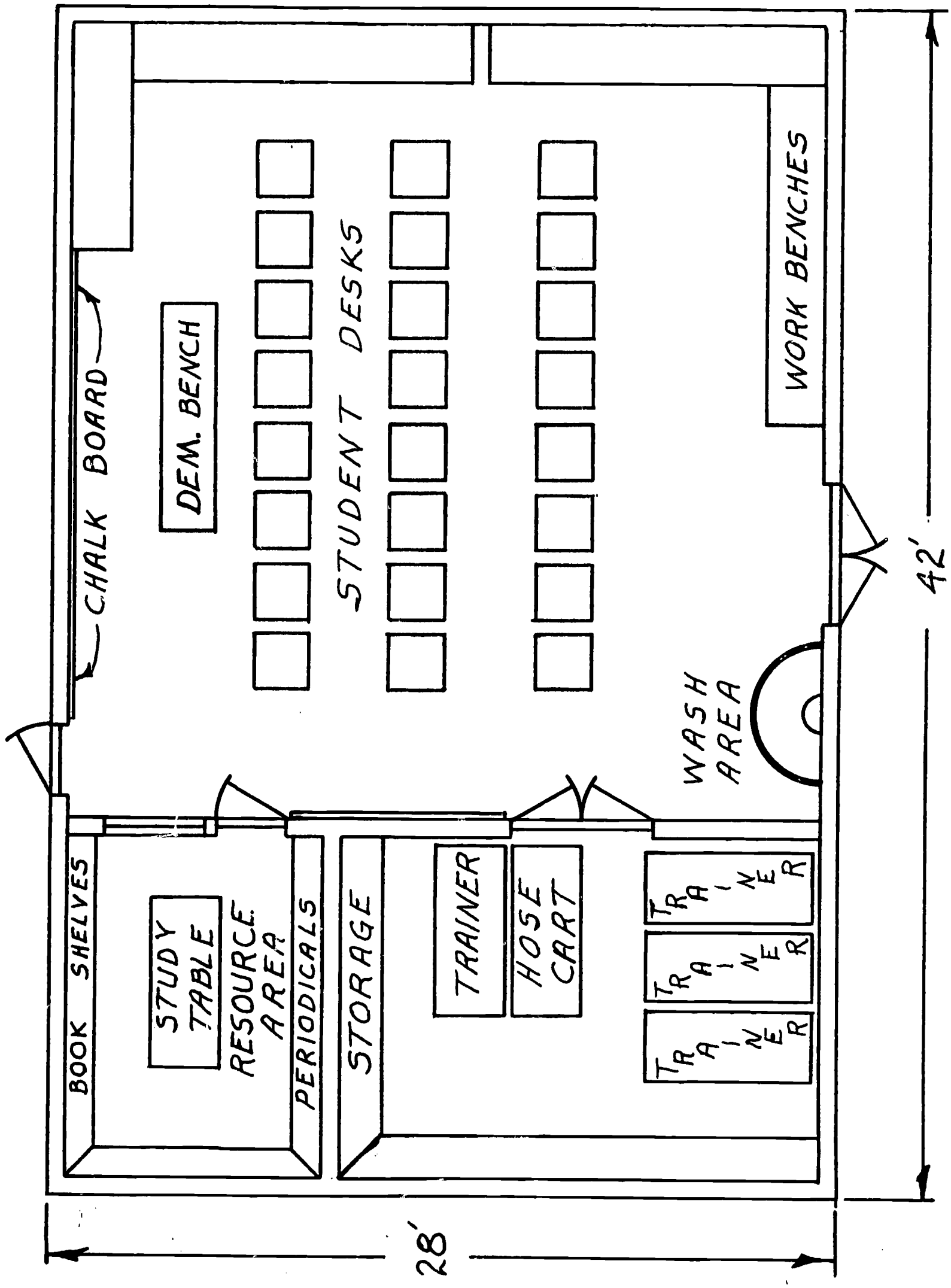
Hydraulic:

Hydraulic trainer with power unit.
Quick disconnect hose couplings.
Hose rack.
Assortment of components.

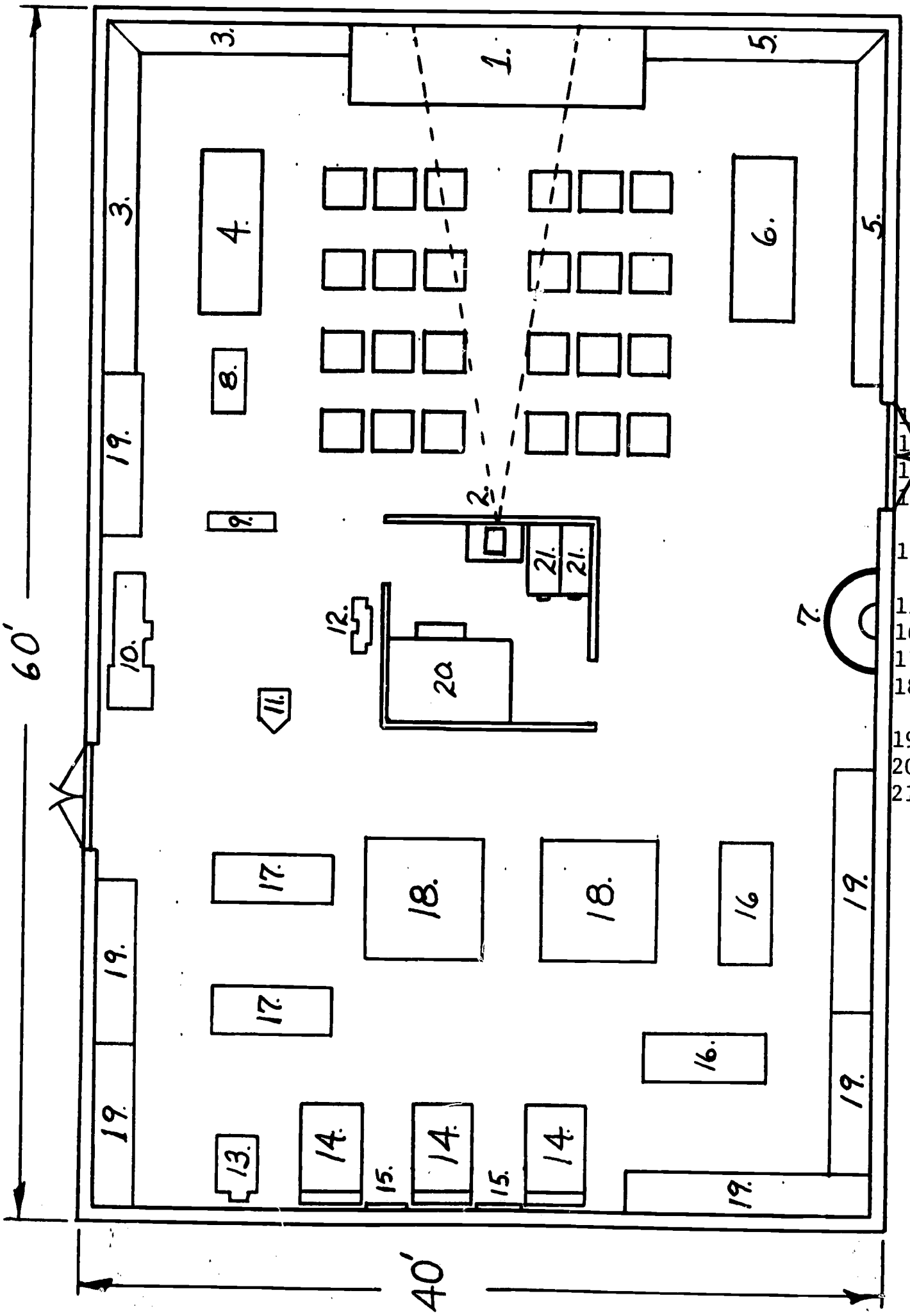
General:

Arbor press (hydraulic)
Drill Press
Grinder
Metal lathe
Component storage
Parts washer
Hoist
Hydraulic oil supply
Oil dry Compound
Appropriate hand tools
Provision for eye and clothing protection
Portable chalk board
Resource and literature display

This dual purpose area will accomodate twenty-four students allowing floor space of 50 sq. ft. per student. The desks are of a design that allows for stacking so that the space may be used for laboratory sessions. During the lab periods the trainers, hose cart, and other accessories are brought into the class area for student use. Pupils should be encouraged to use the resource area where they will not be bothered by noise or other typical school interference.

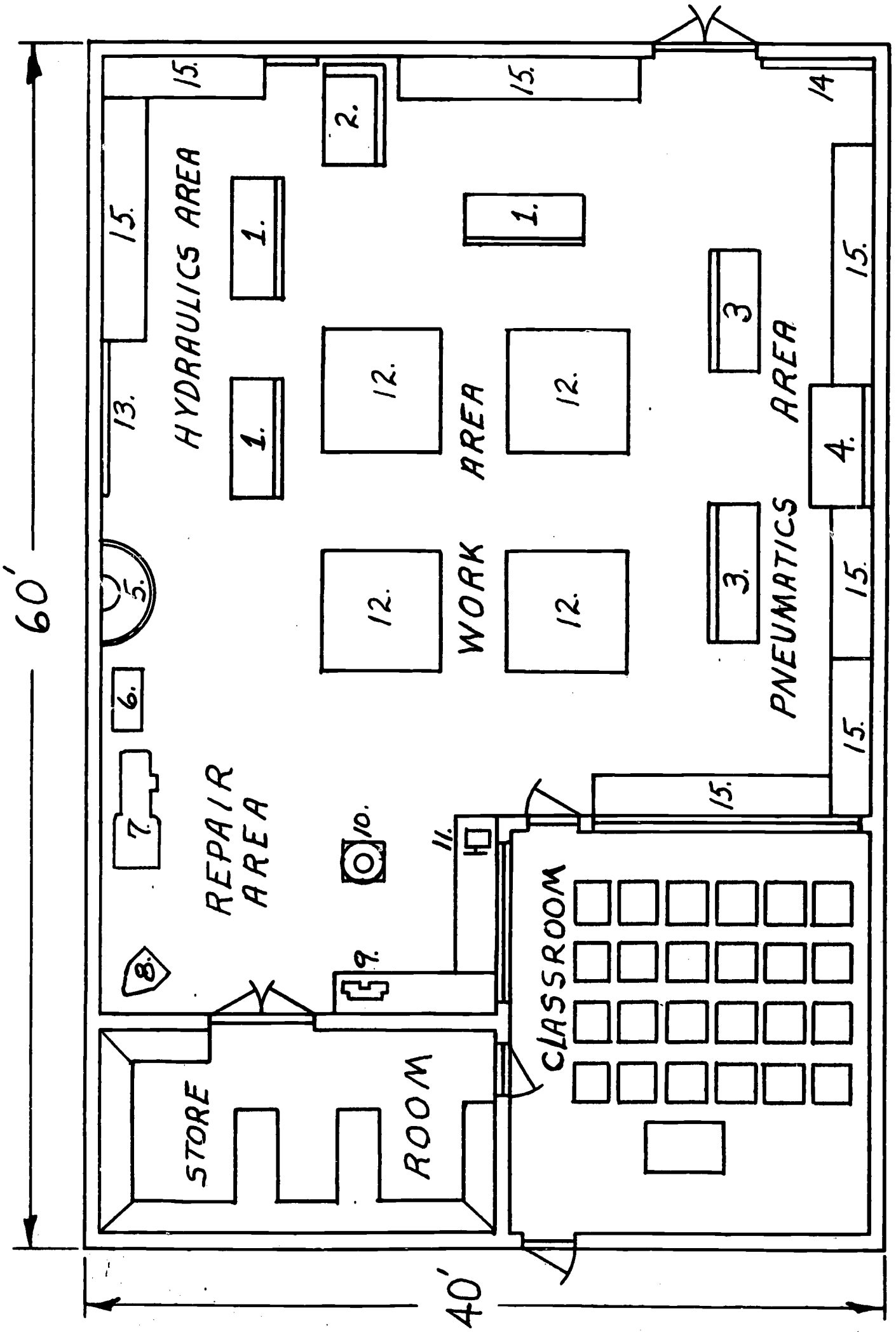


The unique aspect of this laboratory layout is the open type organization which allows for ease of control but requires good administration to maintain good housekeeping. One unique feature is the central office area with audio visual equipment and elevated rostrum area which allows for a compact lecture area. This organizational idea was contributed by John Comer of the WSU faculty.



1. Elevated rostrum
2. Audio-visual equ
3. Hydraulic compon storage
4. Hydraulic demons tion table
5. Pneumatic compone storage
6. Pneumatic demon- stration table
7. Wash area
8. Parts cleaner
9. Hydraulic arbor press
10. Metal lathe
11. Drill press
12. Grinder
13. Portable hydrauli pump
14. Component test stands
15. Hose racks
16. Pneumatic trainer
17. Hydraulic trainer
18. Work benches (four station)
19. Work benches
20. Desk
21. File cabinets

The floor space allowance is 100 sq. ft. per student which meets the present day desired standards for shops of this capacity. Separation of the hydraulics area from the pneumatics permits the components to be kept separate, thereby reducing potential accidents. Special student projects and repair work can be done in the machine area.



1. Hydraulic trainers
2. Component test stand
3. Pneumatic trainers
4. Component test stand
5. Wash area
6. Parts cleaner
7. Small metal lathe
8. Drill press
9. Bench grinder
10. Tube bender
11. Hydraulic arbor press
12. Four station benches
13. Hydraulic hose rack
14. Pneumatic hose rack
15. Work benches

APPENDIX A

PARTICIPANTS IN

1968 NDEA FLUID POWER INSTITUTE

Participants	Local High Schools
Jim Acord	Fontana High School 9453 Citrus Avenue Fontana, California 91225
Jerry Cohen	Pershing High School 18775 Ryan Road Detroit, Michigan 48234
Albert W. Dahlberg	Lamphere High School 13 Mile Road Madison Heights, Mich. 48071
Ronald W. Dunn	Ernest Righetti High School 945 East Foster Santa Maria, California 93454
T. J. Eastlack	Arbor Heights Junior High 8601 Martha Street Omaha, Nebraska 68124
Joel D. Fowler	T. W. Brown Junior High 3333 Sprague Dallas, Texas 75236
Gerald Golden	Western High School 1500 Scotten Avenue Detroit, Michigan 48209
Gerald L. Greischar	Industrial Arts Department Fairmont Senior High School District 454 Fairmont, Minnesota 56031

APPENDIX A (Cont.)

Participants	Local High Schools
John E. Gundersen	Highland High School 2166 S. 17th Street Salt Lake City, Utah 84106
Robert Henderson	Cody High School 18445 Cathedral Detroit, Michigan 48228
Frank Jolly	Department of Industrial Education Humboldt State College Arcata, California 95521
Eugene J. Kirby	Co-Operative Machine Department East Boston High School White and Brooks Street East Boston, Massachusetts 02107
Ed Moomaugh	Stadium High School 111 N. "E" Street Tacoma, Washington 98403
James E. McGraw	Industrial Arts Department Willson Junior High School 1625 East 55th Street Cleveland, Ohio 44103
Andrew M. McClenny	Carver High School Box N Richmond, Virginia 23831
Henry C. Ortner	Moorhead Senior High School 2300 4th Avenue South Moorhead, Minnesota 56560

APPENDIX A (Cont.)

Participants	Local High Schools
Max Pleasant	Department of Industrial Education Cass Technical High School 2421 Second Detroit, Michigan 48201
Earl K. Reynolds	Department of Industrial Education Bend Senior High School Bend, Oregon 97701
Claude Tate, Jr.	Industrial Arts Department Rebuen McCall Senior High School 803 Fish Street Tallulah, Louisiana 71282
R. W. Thornton	Department of Industrial Education North Texas State University Box 5328 N.T. Station Denton, Texas 76203
Roger A. Vicroy	Industrial Education Department Glassboro State College Glassboro, New Jersey 08028
Arlen R. Van Fossen	Central Union High School 2045 N. Dickenson Fresno, California 93702
Richard A. Weiss	Auto Aero Ref. Technical Department Cass Technical High School 2421 Second Avenue Detroit, Michigan 48201
Robert Zanello	Guilford High School Spring Creek Road Rockford, Illinois 61111

APPENDIX B

LECTURERS AND CONSULTANTS

Albert Ackerman
Sales Manager
MacValve Company
Oak Park, Michigan 48237

TOPIC: Pneumatics

POSITION: Sales Manager

George Altland
Customer Training
Vickers Hydraulic School
Troy, Michigan 48084

TOPIC: Hydraulic Circuitry

POSITION: Manager of Customer Training

Gerald B. Baysinger
Associate Professor
Dept. of Industrial Education
Wayne State University
Detroit, Michigan 48202

TOPIC: Integrating Fluid Power

POSITION: Former Institute Director on Fluid Power

Thomas Burford
Department of Instructional Technology
Wayne State University
Detroit, Michigan 48202

TOPIC: Production of Visuals

Max F. Covert
Training Section
Salaried Personnel and Training
Manufacturing Services
Ford Motor Company
Dearborn, Michigan 48210

TOPIC: Opportunities in Fluid Power

POSITION: Supervisor of Training Section

Dr. Paul W. DeVore
Department of Industrial Arts
College of Human Resources and Education
West Virginia University
Morgantown, West Virginia 26505

TOPIC: Study of Technology

POSITION: Professor in Department of Industrial Arts

Arthur C. Evans, Jr.
Pressed Metal Plant
Pontiac Motors Division
Pontiac, Michigan 48053

TOPIC: Fluid Controls

POSITION: Processing Engineer

APPENDIX B (Cont.)

Leonard Gau
P.O. Box 1118
Chrysler Corporation, Dept. 9210
Detroit, Michigan 48231

TOPIC: Fluids

POSITION: Senior Research Scientists

Russel W. Henke, Professor
Fluid Power Institute
Milwaukee School of Engineering
1025 N. Milwaukee Street
Milwaukee, Wisconsin 53201

TOPIC: Instrumentation

POSITION: Institute Director and Vice-President of the National Fluid Power Society

Tom McMaster
Rosaen Filter Company
1776 E. Nine Mile
Hazel Park, Michigan 48073

TOPIC: Fluid Conditioners

POSITION: General Sales Manager

Stig E. Ralstrom
Western High School
1500 Scotten Avenue
Detroit, Michigan 48209

TOPIC: Teaching Practice to Prevent Dropouts

POSITION: Instructor

Dr. Charles Risher, Professor
Department of Industrial Education
Western Michigan University
Kalamazoo, Michigan 49003

TOPIC: Strategies for a Model Program

POSITION: NDEA Institute Director

Jack Robinson
Pitney Bowes
8200 2nd Avenue
Detroit, Michigan 48202

TOPIC: Fluidics

Dave Royer
Rosaen Filter Company
1776 E. Nine Mile
Hazel Park, Michigan 48073

TOPIC: Fluid Conditioners

POSITION: Engineer

APPENDIX C

THE FLUID POWER SOCIETY

THE FLUID POWER SOCIETY - a professional organization performing an educational and technological function, serves the interests of education and industry.

The Fluid Power Society has been actively engaged in promoting educational opportunities in the fluid power technology for the past decade. Teachers of fluid power cannot afford to ignore the benefits derived from active participation in local or the national chapter.

Specific information on the administration, organization, membership, and benefits of this society are provided to assist you become an active member.

Administration

THE FLUID POWER SOCIETY

Executive Officer	
Chairman	Russell Henke Elm Grove, Wisconsin 53122
Administrative Office	International Headquarters Fluid Power Society P. O. Box 49, Thiensville, Wisconsin 53092 U.S.A.
Phone	Area Code 414/242-2010

Organization and Membership

Four categories of membership are available in the Fluid Power Society. The largest segment consists of Regular Members, those whose primary professional and technical interests are in fluid power technology and

APPENDIX C (Cont.)

engineering and who, through Society affiliation, desire to contribute to the scientific and educational objectives of the Society. Active members, in turn, keep abreast of developments in fluid power through the Society's publications, annual technical meetings, and local chapter functions.

Individuals and organizations who wish to make a larger material contribution to support the Society's projects may become Sustaining Members. Qualified students may become Student Members, and the Society periodically honors leaders in fluid power by designating them Honorary Members.

The local chapters are the vertebrae which make up the backbone of the Society. They are the focal points of continuing activities, projects, and meetings.

Establishment of Society policy and continuity of operation are provided by the elected Board of Directors. So that chapters may also have a voice in the Society's government, each chapter is represented in a House of Delegates which meets annually, reviews Society activities, and serves in an advisory capacity to the Board. The Headquarters Office located in Thiensville, Wisconsin, a suburb of Milwaukee, includes the full-time staff of the Society. Here the membership records are kept, and the business of the society is conducted.

Activities

On the national and international scenes, the Society is recognized as the spokesman for fluid power engineering and technology. Examples of such recognition are its co-sponsorship of the biennial Fluid Power International Exposition and Conference, held in each even-numbered year in London, England, and its co-sponsorship of the National Conference on Fluid

APPENDIX C (Cont.)

Power held concurrently with the Society's Annual Meeting each year in the United States. Its membership in, and co-sponsorship of the Council for Fluid Power Education, and its recognition by national governments and educational agencies as the "center" of fluid power knowledge in the United States, Canada, Australia, and Great Britain was a fortunate development.

The Society is an institutional member of the American Automatic Control and the American Society for Engineering Education; and is a member of Sectional Committee B93, Fluid Power Systems and components, USA Standards Institute.

Benefits

Fluid Power Society members qualify to receive two outstanding publications, through the Hydraulics & Pneumatics, the Magazine of Fluid Power Systems. The thorough coverage in this magazine of technical and engineering news in Europe adds greatly to the scope of members' knowledge.

Members may also take advantage of two Society group insurance plans. One provides low cost term life insurance, and the other is an income protection plan which offers protection for as long as a lifetime in case of disabling illness or accident. Participation in local chapter activities enables the teacher to benefit most from the sponsored activities and association with representatives from the fluid power industry.

> The primary reason for this action was to provide an identifiable agency responsible for formal programming in education on an international scale.
>
> The purpose of the Fluid Power Society Education Institute is to help develop seminars, conferences, symposia, and short courses of greater scope and on a broader base than individual chapters can undertake.

APPENDIX C (Cont.)

Publications

The official publication of the Society is the "FPS News", which is published monthly in Hydraulics & Pneumatics. All members are eligible to receive the publication. Also, members may receive the Fluid Power International, a British publication at no cost.

The Directory of Members is published annually. Other publications include educational manuals and chapter communications. Under a cooperative arrangement with the National Fluid Power Association, standards and technical manuals published by NFPA are available to FPS members at reduced cost.

The Fluid Power Handbook & Directory can also be purchased from the Fluid Power Society.

Other Publications Available

The following publications are available at prices listed from the Society's Headquarters Office. On most publications, discounts are allowed for quantity orders of ten or more. Inquiries should be directed to the Society, P.O. Box 49, Thiensville, Wisconsin 53092.

Technical Manuals	Price
Fluid Power -- An outline of technical Content and Suggested Resource materials	$2.00 ea.
Hydraulic Systems, by Russell W. Henke	2.00 ea.
Standards	
Glossary of Terms for Fluid Power Code USASI B.93.2-1965	.75 ea.
Cylinder Bore and Piston Rod Sizes Code USASI B93.3-1965	.04 ea.

Electric Resistance Welded Hydraulic Line Tubing Code USASI B93.4-1966	.75 ea.
Graphic Symbols for Fluid Power Diagrams Code USASI Y32.10-1966	2.50 ea.
Drafting Standards for Fluid Power	2.50 ea.
Diagrams: Code USASI Y14.17-1966	2.50 ea.
Filtration for Hydraulic Fluid Power Systems Code NFPA T 3.10.65.2	.75 ea.
Hydraulic Filtration Standard Code NFPA T 3.10.65.1	.04 ea.
Procedures for the Use of Fire Resistant Fluids Code USASI B93.5-1966	.50 ea.
Mounting Flanges & Shafts for Pumps and Motors Code USASI B93.6-1966	.50 ea.
Cylinder Dimension Identification Code Code USASI B93.1-1964	.75 ea.

The Hydraulics & Pneumatics Magazine carries current published materials under the heading of: "Your Fluid Power File". Check or money order should accompany orders for publications, payable to the Fluid Power Society.

EDUCATIONAL INSTITUTE ESTABLISHED BY BOARD

The primary reason for this action was to provide an identifiable agency responsible for formal programming in education on an international scale. The purpose of FPS-EI is to help develop seminars, conferences, symposia, and short courses of greater scope and on a broader scale than individual chapters can undertake.

FLUID POWER SOCIETY MEMEBERSHIP

NUMERICAL LISTING

1 -- Detroit, Michigan
2 -- Milwaukee, Wisconsin
3 -- Chicago, Illinois
4 -- Cleveland, Ohio
5 -- Minneapolis-St. Paul, Minn.
6 -- Rockford, Illinois
7 -- Indiana
8 -- Toledo, Ohio
9 -- Boston, Massachusetts
10 -- Toronto, Ontario, Canada
11 -- Houston, Texas
12 -- Rhode Island
13 -- Seattle, Washington
14 -- Montreal, Quebec, Canada
15 -- Saginaw, Michigan
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21 -- Syracuse, New York
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23 -- Philadelphia, Pennsylvania
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26 -- Atlanta, Georgia
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29 -- New York
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31 -- Connecticut
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33 -- Pittsburgh, Pennsylvania
34 -- California
35 -- Racine-Kenosha, Wisconsin
36 -- St. Louis, Missouri
37 -- Rochester, New York
38 -- Peoria, Illinois
39 -- Cincinnati, Ohio
40 -- Huntsville, Alabama
41 -- Georgia
42 -- Indianapolis, Indiana
43 -- Northern California
46 -- Greensboro, North Carolina
47 -- Phoenix, Arizona (Central Arizona Chapter)
48 -- Spokane, Washington
A -- Alpha, Kenosha Tech. Institute
A-1 -- Milbourne, Australian Section
A-2 -- Sidney
A-3 -- Adelaide
B-1 -- Birmingham-Midlands, British Section
B-2 -- London
B-3 -- Leeds
1 -- International Chapter

Chapter Officers

Detroit Chapter
No. 1
-President-Joe Allbs, 1641 Hollywood, Dearborn
-Secretary-George Schuran, 33038 Willow Lane, Fraser

Chicago Chapter
No. 3
-President-Vaughn Nelson, 5381 Middaugh, Downers Grove
-Secretary-S.C. Baker, 1611 E. Newberry, Chicago

Minn.-St. Paul
Chapter No. 5
-President-W. Bruce Jenkinson, Hydra-Power Inc., Minneapolis
-Secretary-Dean Wickoren, Equipment Parts & Service, St. Paul
-Res. Agent-Bruce Jenkinson

Rockford Chapter No. 6	-President-Ted Brolund, 603 Sunrise Ln., Rockford -Secretary-Robert A. Zanello, 2525 Ohio Pkwy., Rockford -Res. Agent-Ian Proudfoot, 29 Airport Dr., Rockford
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Northern California No. 43	-President-A.B. Roth, 3376 Springhill Road, Lafayette -Secretary-R.H. Edson, FMC Corp. P.O. Box 2812, San Jose

APPENDIX D

LABORATORY TEST EQUIPMENT

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