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ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the auto mechanic occupation. It identifies the broad area of skills and knowledge necessary to perform various tasks involved in diagnosis, maintenance, and repair of automotive systems. Selected supervisory tasks involved in running a shop employing several mechanics are included. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Seventeen duties are broken down into a number of tasks and for each task a two-page table is presented, showing on the first page: tools, equipment, materials, objects acted upon; performance knowledge (related also to decisions, cues and errors); safety--hazard; and on the second page: science; math--number systems; and communications (performance modes, examples, and skills and concepts). The duties include: keeping records; supervising mechanics lubricating and maintaining vehicles; servicing engine block assemblies; servicing and repairing cooling systems, fuel systems, valve trains, ignition systems, braking systems (drum and disk), steering units and A/C units; repairing and aligning front end assemblies; repairing rear axle and drive line, and standard and automatic transmissions; and maintaining and repairing electrical systems. Abbreviations of automative terms are appended. (BP)

CE004162

# AUTO MECHANIC



Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

5030

# AN ANALYSIS OF THE AUTO MECHANIC OCCUPATION

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Occupational Analysis
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June 1, 1973 to December 30, 1974
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The Instructional Materials Laboratory
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# FOREWORD

The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant form the U.S. Office of Education.

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixty-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the vairous tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures, as well as identifying specific supporting skills and knowledge in the academic subject areas.

# PREFACE

This occupational analysis describes the duties and tasks required of an auto mechanic. It identifies the broad area of skills and knowledge necessary to perform various tasks involved in diagnosis, maintenance, and repair of automotive systems. Selected supervisory tasks involved in running a shop employing several mechanics are included.

# ACKNOWLEDGMENT

We wish to acknowledge the valuable assistance rendered by the following subject matter specialists. They provided input to the vocational instructors in identifying related skills and concepts of each respective subject matter area and served as training assistants in the analysis process during the two-week workshops.

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# JOB DESCRIPTION

The professional Auto Mechanic will be able to maintain, diagnose and repair an automobile. His or her duties will include the following: maintenance and repair of engines, cooling systems, electrical systems, fuel, exhaust and emission control systems, power trains, suspension systems, steering and alignment systems, brakes, standard and automatic transmissions and heating and air-conditioning systems; all of which pertain to the service of the automobile.

## DUTY A. KEEPING RECORDS

1. Plan, schedule and control maintenance of vehicles
2. Maintain warranty records and complete P/M sheets
3. Complete work order and post inventory
4. Initiate and complete parts and supplies orders

# (TASK STATEMENT) A-1 PLAN, SCHEDULE AND CONTROL MAINTENANCE OF VEHICLES

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## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Daily shop schedule
P M sheets
Workorders
Post inventory

## PERFORMANCE KNOWLEDGE

Complete daily shop schedule
Preform daily P/M sheets
Complete workorders
Maintain inventory

## SAFETY – HAZARD

## DECISIONS

Determine if shop schedule is complete
Determine what equipment needs P M sheets
Determine if workorder lists all parts and repairs
Determine if inventory is adequate to meet needs

## CUES

Too little or too much work in shop
Equipment failure
Loss of income
No parts on hand for repairs or too large an inventory

## ERRORS

Men not making money or can not complete all job
Loss of equipment use
Loss of income
Incomplete jobs or too many parts on hand

## (ASK STATEMENT) A-1 PLAN, SCHEDULE AND CONTROL MAINTENANCE OF VEHICLES

### SCIENCE

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs
- Measurement: Non-geometric
  - Time/calendar
  - Weight
  - Liquid

Set of Real Numbers - Rationals

Uses of Numbers (without calculation)
- Counting
- Indexing
- Coding given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

Use of Computing Devices and Mechanical Aids - Calculators

Basic Statistical Skills and Concepts - Measurement of central tendency via mean (average), median, standard deviation

Basic Logic - Deductive Inductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check PM Sheets | Comprehension<br>Terminology<br>Process Report (Instruction) |
| Writing | Schedule Work Orders | Penmanship<br>Spelling<br>Classi<br>Repo mmendations)<br>Term<br>Clarity ession<br>Logic |
| Viewing | Post Inventory | Visual A. s<br>Memory<br>Detail and Inference<br>Recognition of Symbols |

## (TASK STATEMENT) A-2 MAINTAIN WARRANTY RECORDS AND COMPLETE P/M SHEETS

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Warranty records forms<br>P M sheet forms | Maintain warranty record file<br>Maintain P M sheet file | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine if all customers are listed<br>Determine if all equipment is listed | Customer with no card<br>Equipment with no sheet | Loss of customer<br>Equipment failure |

## (TASK STATEMENT) A-2 MAINTAIN WARRANTY RECORDS AND COMPLETE P/M SHEETS

### SCIENCE

Liability
P M records

The following principles of behavioral patterns should be included:

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs
- Measurement: Non-geometric
  - Time/calendar
  - Weight
  - Liquid

Set of Real Numbers Rationals
Uses of Numbers, (without calculation)
- Counting
- Indexing
- Coding --given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

Use of Computing Devices and Mechanical Aids --Calculators
Basic Probability Skills and Concepts
- Use of probability of mass behavior v s. unpredictability of single events.

Basic Logic--Deductive Inductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check PM Sheets | Comprehension<br>Terminology<br>Process Report (Instruction) |
| Writing | Schedule Work Orders | Penmanship<br>Spelling<br>Classification<br>Reports (Recommendations)<br>Terminology<br>Clarity of Expression<br>Logic |
| Viewing | Post Inventory | Visual Analysis<br>Memory<br>Detail and Inference<br>Recognition of Symbols |

(TASK STATEMENT) A-3 COMPLETE WORK ORDER AND POST INVENTORY

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Work Order
Price List
Catalog
Inventory Cards

## PERFORMANCE KNOWLEDGE

Examine W.O. for Errors
Extend prices on parts
Check parts numbers
Total parts & labor prices
Post parts out of stock
Order parts in below stocking level

## SAFETY – HAZARD

## DECISIONS

Determine if parts are listed correctly
Determine discounts if allowed
Determine correct labor costs

## CUES

Check catalog
Customer discount list
Rate book prices

## ERRORS

Wrong parts posted on W.O.
Wrong parts posted on inventory
Incorrect labor cost charges

## (TASK STATEMENT) A-3 COMPLETE WORK ORDER AND POST INVENTORY

| SCIENCE | MATH – NUMBER SYSTEMS |
|---|---|
| | |

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading<br><br>Viewing | Price list<br>Parts catalog<br><br>Work order for errors | Comprehsnison<br>Terminology<br><br>Visual Analysis<br><br>Recognition of symbols |

# (TASK STATEMENT) A-4 INITIATE AND COMPLETE PARTS AND OILS ORDER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Parts order torm<br>Oil order form | List part by name and number<br>List oils by name, weight and type | |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine what parts are needed and where to buy<br>Determine types and amount of oils needed | No parts or wrong parts on hand<br>No oils or wrong type on hand | Job incomplete<br>Loss of customers |

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## ASK STATEMENT) A-4 INITIATE AND COMPLETE PARTS AND OILS ORDER

### SCIENCE

Specifications
Viscosity

The following principles of behavioral patterns should be included:

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc.
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs
- Measurement: Non-geometric
  - Time/calendar
  - Weight
  - Liquid

Set of Real Numbers Rationals
Uses of Numbers (without calculation)
- Counting
- Indexing
- Coding—given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

Use of Computing Devices and Mechanical Aids Calculators
Basic Probability Skills and Concepts
- Use of probability of mass behavior v.s unpredictability of single events

Basic Logic—Deductive/Inductive
Basic Measurement Skills and Concepts
- Measurement: Geometric
  - Linear

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check PM Sheets | Comprehension<br>Terminology<br>Process Report (Instruction) |
| Writing | Schedule Work Orders | Penmanship<br>Spelling<br>Classification<br>Reports (Recommendations)<br>Terminology<br>Clarity of Expression<br>Logic |
| Viewing | Post Inventory | Visual Analysis<br>Memory<br>Detail and Inference<br>Recognition of Symbols |

## DUTY B. SUPERVISING MECHANICS

1. Maintain work control and monitor workload and down time
2. Prepare time and attendance records and medical accident reports

# (TASK STATEMENT) B-1 MAINTAIN WORK CONTROL AND MONITOR WORK

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Shop foreman check list
Daily shop schedule
Part inventory

## PERFORMANCE KNOWLEDGE

Follow shop foreman's check list and assign all duties
Schedule customer cars for service and repairs
Maintain part inventory to assure minimum down time

## SAFETY – HAZARD

## DECISIONS

Determine if all jobs from foreman check list are complete
Determine if all customer cars are listed on daily shop schedule
Determine if all parts needed for repair are on hand

## CUES

Jobs not being completed and loss of equipment use
Customer car not being serviced or repaired
No parts on hand to complete repairs

## ERRORS

Loss of time and money, loss of use of shop equipment
Unsatisfied customers, loss of income
Too much down time, unsatisfied customers, loss of income

## (TASK STATEMENT) B-1 MAINTAIN WORK CONTROL AND MONITOR WORK

### SCIENCE

Daily work schedule
Part inventory

The following principles of behavioral patterns should be included:

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc.
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs
- Measurement: Non-geometric
  - Time/calendar
  - Weight
  - Liquid

Set of Real Numbers: Rationals
Uses of Numbers: (without calculation)
- Counting
- Indexing
- Coding: given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

Use of Computing Devices and Mechanical Aids: Calculators
Basic Probability Skills and Concepts
- Use of probability of mass behavior v.s. unpredictability of single events

Basic Logic: Deductive/Inductive
Basic Measurement Skills and Concepts
- Measurement, Non-geometric
  - Money/Interest

Fundamental Operations (Calculation)
Basic Arithmetic Skills and Concepts
- Finding a percent of a number and what percent one number is of another
- Ratio and proportion

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check PM Sheets | Comprehension<br>Terminology<br>Process Report (Instruction) |
| Writing | Schedule Work Orders | Penmanship<br>Spelling<br>Classification<br>Reports (Recommendations)<br>Terminology<br>Clarity of Expression<br>Logic |
| Viewing | Post Inventory | Visual Analysis<br>Memory<br>Detail and Inference<br>Recognition of Symbols |
| Speaking | Instructions to mechanics | Terminology<br>Gestures<br>Dress |

# B-2 PREPARE TIME AND ATTENDANCE RECORDS, MEDICAL AND ACCIDENT REPORTS

(TASK STATEMENT)

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Time cards
Attendance records
Medical forms
Accident reports

## PERFORMANCE KNOWLEDGE

Check and total time cards weekly
Check and complete attendance records daily
Complete medical reports as needed
Complete accident reports as required

## SAFETY – HAZARD

## DECISIONS

Determine if time card total matches work completed
Determine if attendance record are complete
Determine if medical forms are filled out properly
Determine if accident report are filled out and completed as required

## CUES

Number of cards turned in
Absents do not match attendance reports
No follow up from insurance company
No follow up from front office

## ERRORS

Mistakes in payroll
Truant personal
No payment from insurance company
Lawsuit, lost time

# B-2 PREPARE TIME AND ATTENDANCE RECORDS, MEDICAL AND ACCIDENT REPORTS

ASK STATEMENT)

## SCIENCE

Time cards
Medical reports
Accident reports

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH — NUMBER SYSTEMS

Set of Real Numbers Rationals
Uses of Numbers: (without calculation)
- Counting
- Indexing
- Recording

Basic Measurement Skills and Concepts
Measurement: Non-geometric
- Time/calendar
- Money interest

Reading and Interpreting Tables, Charts, and Graphs
Fundamental Operations (Calaulation)

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check Reports | Comprehension<br>Terminology<br>Process report (instruction) |
| Writing | Fill in time cards, Medical cards, Accident Reports<br>Write business letters | Penmanship<br>Spelling<br>Classification<br>Reports (recommendations)<br>Terminology<br>Clarity of expression<br>Logic |
| Viewing | Check Accident Scene<br>Check Hazard | Visual analysis<br>Memory<br>Detail and inference<br>Recognition of symbols |
| Speaking | Report Hazard and Safety Correction | Terminology<br>Gestures<br>Dress |

## DUTY C. LUBRICATING AND MAINTAINING VEHICLES

1. Perform safety inspection, lubricate, and change oil and filters, service hardware

2. Maintain, remove, repair or replace tires

# C-1 PERFORM SAFETY INSPECTION, LUBRICATE, CHANGE OIL & FILTERS AND SERVICE HARDWARE

(TASK STATEMENT)

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Grease pan
Drain pan
Oil and fuel filter wrench
Oil can
Oil can cutter

Chassis & tires
Oil Pan
Filter mountings
Hardware

## PERFORMANCE KNOWLEDGE

Safety inspection
Lube chassis
Change oil
Change oil and fuel filter
Lube hardware

## SAFETY – HAZARD

Wear safety glasses
Do not remove radiator cap if engine is hot

Foreign material may get into eyes
Would get burned from steam pressure

## DECISIONS

Determine if safety items will meet manufacture specifications
Determine what type of lube to use
Determine what type of oil to use
Determine if the replacement filters meet manufacture specifications
Determine what type of lube to use on hardware

## CUES

Loose or worn parts
Owner's manual
Parts manual

## ERRORS

Accidents
Engine damage
Road failure

# C-1 PERFORM SAFETY INSPECTION, LUBRICATE, CHANGE OIL & FILTERS AND SERVICE HARDWARE

(TASK STATEMENT)

## SCIENCE

Engine oils
Lube
Oil pump
Engine oils
Lube and oils
Fan belts

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Basic Logic
- Deductive inductive

Basic Measurement Skills and Concepts
- Instruments, ruler, compass protractor clinometer tape calipers micrometer thermometer barometer tachometer and others.
- Metric and English measure and conversion
- Measurement Geometric
  - Volume
- Measurement Non-geometric
  - Liquid
- Reading and Interpreting tables, charts, and graphs
  - Logs

Set of Real Numbers
- Rationals

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Check Lube & Oil Charts | Comprehension<br>Terminology |
| Writing | Fill in PM report | Penmanship<br>Spelling<br>Reports (Recommendations)<br>Terminology |
| Listening | For Abnormal Sounds<br>(squeaks; rattles, knocks, etc.) | Auditory Discrimination |
| Viewing | Rust, Bends, Tears, etc<br>Rough, broken glass | Visual analysis<br>Describing<br>Logic<br>Detail and inference |
| Touching | | Temperature<br>Consistency |
| Smelling | Oil or gas fumes or burning | Odor (oil) (coolant) |

# C-2 MAINTAIN, REMOVE, REPAIR OR REPLACE TIRES (INSPECT & (TASK STATEMENT, SERVICE TIRES)

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## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Tire changer
Rubber lube
Wheel wrench
Jack
Pressure gauge
Patching

Wheels
Tires

## PERFORMANCE KNOWLEDGE

Inspect
Check air pressure
Repair flats
Replace tires

## SAFETY – HAZARD

Wear safety glasses
Proper use of tools

Foreign materials could get in eyes
Hands, hair, loose clothing could catch in moving parts

## DECISIONS

Determine if these tires will provide trouble free performance
Determine proper air pressure
Use proper type of repair
Determine what type tire to replace with

## CUES

Cuts, breaks, tread wear, air loss

## ERRORS

Flat tire
Accident

## C-2 MAINTAIN, REMOVE, REPAIR OR REPLACE TIRES (INSPECT & SERVICE TIRES)

ASK STATEMENT)

### SCIENCE

Tire changer
Wheel wrench
Tire
Road friction
Tire body

### MATH — NUMBER SYSTEMS

Set of Real Numbers Whole numbers
Basic Measurement Skills and Concepts
Measurement Geometric
Volume
Instruments:
Measurement Non-geometric
[Pressure]
Basic Logic
Deductive inductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology |
| Reading | Charts--tire pressure, size | Comprehension<br>Terminology |
| Writing | Report condition, repairs, & cost | Penmanship<br>Spelling<br>Reports |
| Listening | Air Leak | Auditory discrimination |
| Viewing | Abnormal wear patterns | Visual analysis<br>Logic<br>Symbols & codes |
| Touching | Rough trend or lumps, or leatheredging | Shape |

## DUTY D. SERVICING AND REPAIRING COOLING SYSTEMS

1. Diagnose cooling and heating systems problems
2. Replace cooling systems components

# (TASK STATEMENT) D-1 DIAGNOSE COOLING AND HEATING SYSTEMS PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Light
Inspection mirror
Pressure tester

Belts
Fan
Hoses
Radiator
Heater core
Freeze plugs

## PERFORMANCE KNOWLEDGE

Visually inspect belts for cracks, breaks, glazing, and tension
Inspect fan
Inspect hoses for cracks or deterioration
Inspect radiator & heater cores for leaks and mounting problems

## SAFETY – HAZARD

Wear safety glasses
Make sure engine is off and will not start
Do not remove radiator cap if engine is hot

Foreign material or steam could get in eyes
Hands or hair or loose clothing could catch in moving parts
Would get burned by steam pressure

## DECISIONS

Determine if these units provide trouble free performance

## CUES

Leaks, noises, overheating complaints

## ERRORS

Engine overheating
Result
Road breakdown
Engine damage

## ASK STATEMENT) D-1 DIAGNOSE COOLING AND HEATING SYSTEMS PROBLEMS

### SCIENCE

Fan belts and pulleys
Water pump
Pressure caps
Water pump
Hydrometer
Radiator
Fan belts and hoses

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Logic Deductive inductive
Set of Real Numbers Rationals
Uses of Numbers (Without calculation)
- Ratio

Basic Measurement Skills and Concepts
- Measurement Geometric
  - Volume
- Measurement Non-geometric
  - Temperature
  - Liquid [Coolant]

- Reading and Interpreting Tables, Charts, and Graphs
  - Logs [ Coolant mixing chart]
- Instruments
  - [Pressure tester, hydrometer]

Basic Arithmetic Skills and Concepts
- Ratio and proportion
- [Coolant solution]

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic<br>Gestures |
| Reading | Chart, Hydrometer | Comprehension<br>Informational reports<br>Terminology |
| Writing | Evaluate, cost estimate | Penmenship<br>Spelling<br>Terminology<br>Logic |
| Listening | Overheat<br>Boiling Sounds | Auditory discrimination<br>Logic |
| Viewing | Visual signs, leaks, etc | Visual analysis |
| Touching | | Temperature |
| Smelling | Burning | Odor |



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# (TASK STATEMENT) D-2 REPLACE COOLING SYSTEM COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S I K
Pressure tester

Water pump
Hoses
Belts
Thermostat
Fan
Radiator core
Heater core
Freeze plugs

## PERFORMANCE KNOWLEDGE

Replace water pump
Replace hoses
  Heater
  Cooling systems
Replace thermostat
Replace radiator core
Replace heater core
Replace freeze plugs

## SAFETY – HAZARD

Wear safety glasses

Proper use of hand tools

Make sure engine will not start
Wait till engine cools before removing cap

Foreign material or steam could get in eyes
Hands, hair, loose clothing could catch in moving parts

Would get burned by water or steam under pressure

## DECISIONS

Determine if the cooling system will operate properly
Determine if the coolant mixture is correct

## CUES

Visible leaks
Coolant not circulating
Hydrometer shows coolant not adequate

## ERRORS

Heater malfunction
Engine overheating
Engine damage
Engine freeze up

## ASK STATEMENT) D-2 REPLACE COOLING SYSTEM COMPONENTS

### SCIENCE

Simple machines used to gain mechanical advantage  Fans belts and pulleys
Work input, work output, friction and efficiency in simple machines  Water pump
Fluids under pressure  Pressure caps
Centrifugal forces developed by bodies in rotation  Water pump
Resistance of materials to change in shape  Fan belts and hoses

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Logic
- Deductive inductive

Set of Real Numbers
- Rationals

Uses of Numbers (without calculation)
- Ratio

Basic Measurements Skills and Concepts
- Measurement Geometric
  - Linear [Length of heater hose]
  - Volume
- Measurement Non-geometric
  - Temperature
  - Liquid [Coolant]
  - [Pressure]
- Reading and Interpreting Tables, Charts, and Graphs
  - Logs [Coolant mixing chart]
- Instruments:

Basic Arithmetic Skills and Concepts
- Ratio and proportion [Coolant solution]

Basic Algebra Skills and Concepts
- Manipulation of formulae [for every 1 lb pressure, 30 rise]
- Substitute given values in order to find the value of the required unknown [in boiling point]

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic<br>Gestures |
| Reading | Chart, Hydrometer | Comprehension<br>Informational Reports<br>Terminology |
| Writing | Evaluate, Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Boiling Sounds | Auditory discrimination<br>Logic |
| Viewing | Visual signs, leaks, etc | Visual analysis |
| Touching | Overhot | Temperature |
| Smelling | Burning | Odor |

## DUTY E. SERVICING AND REPAIRING FUEL SYSTEMS

1. Diagnose fuel systems problems
2. Test repair and/or replace fuel system components

# (TASK STATEMENT) E-1 DIAGNOSE FUEL SYSTEM PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.I.K
Fuel pump pressure gauge
Combustion analyzer
Vacuum Gauge

Fuel pump
Carburetor
Lines
Fuel tank
Fuel filters
Intake manifold

## PERFORMANCE KNOWLEDGE

Test fuel pump pressure
Analyze combustion
Test manifold vacuum

## SAFETY – HAZARD

Use safety glasses
Fire extinguisher handy
Disconnect & ground coil high tension wire

Gas spray in eyes
Fire could result with fuel
Spark could set fire to spilled fuel

## DECISIONS

Determine condition of pump
Determine combustion efficiency
Determine vacuum level

## CUES

Pump pressure as specified
Correct combustion level
Correct vacuum level

## ERRORS

Car will not run
Car will run poorly
Will lose mileage

## (TASK STATEMENT) E-1 DIAGNOSE FUEL SYSTEM PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage - Fuel pump
Transfer of energy from one form to another - Combustion

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Logic
- Deductive inductive

Basic Measurement Skills and Concepts
- Instruments
- Measurement Geometric
  - Liquid
  - [Pressure (lbs. sq in)]
  - [Vacuum (in of hg )]
  - [Emission control (combustion analyzer p p m )]
- Reading and Interpreting Tables, Charts and Graphs
  - Time calendar [Logs spec. chart]
  - [Infrared conversion chart]

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Complaint | Terminology<br>Logic |
| Reading | Chart – specifications, Gauges | Comprehension<br>Terminology |
| Writing | Cost Estimates | Penmanship<br>Spelling<br>Reports<br>Logic |
| Listening | Uneven idle | Auditory discrimination<br>Logic |
| Viewing | Fuel Leak | Visual analysis<br>Logic<br>Symbols and codes |
| Smelling | Fuel Leaks | Gasoline Odors |

# (TASK STATEMENT) E-2 REPAIR FUEL SYSTEM COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Fuel pump pressure gauge
Combustion analyzer
Vacuum gauge

Fuel pump
Carboretor.
Lines
Fuel tank
Fuel filters
Intake manifold

## PERFORMANCE KNOWLEDGE

Replace carbuetor
Replace lines
Replace fuel pump
Replace fuel filters
Replace intake manifold

## SAFETY – HAZARD

Use safety glasses
Fire extinguisher handy
Do not crank engine with carburetor off

Gas spray in eyes
Presence of gasoline is always dangerous
Spark from ignition will ignite fuel

## DECISIONS

Determine if the fuel systems will operate as specified

## CUES

Fuel pump pressure is low
Combustion mixture is wrong
The fuel lines are pinched or free
Fuel filters are clear
There is a vacuum leak

## ERRORS

Poor performance
Poor mileage

## ASK STATEMENT) E-2 REPAIR FUEL SYSTEM COMPONENTS

### SCIENCE

Simple machines used to gain mechanical advantage  Fuel pump
Transfer of energy from one form to another  Combustion

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Basic Logic
- Deductive inductive

Basic Measurement Skills and Concepts
- Instruments, ruler compass protractor clinometer tape calipers micrometer, thermometer barometer tachometer fuel pressure gauge vacuum gauge combustion analyze, and others

- Measurement: Non-geometric
  - Liquid
  - [Pressure (lbs. sq in.)]
  - [Vacuum (in. of hg.)]
  - [Emission control (combustion analyzer p p m)]
- Reading and Interpreting Tables, Charts, and Graphs
  - Time/calendar -Logs, spec. chart
  - [Infrared conversion chart]

Set of Real Numbers
- Rationals

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Complaint | Terminology<br>Logic |
| Reading | Chart—Specifications, Gauges | Comprehension<br>Terminology |
| Writing | Cost estimate | Penmanship<br>Spelling<br>Reports<br>Logic |
| Listening | Uneven idle | Auditory discrimination<br>Logic |
| Viewing | Fuel Leak | Visual analysis<br>Logic<br>Symbols and codes |
| Smelling | Fuel Leaks | Gasoline odors |

## DUTY F. SERVICING ENGINE BLOCK ASSEMBLIES

1. Diagnose engine problems
2. Clean, disassemble, inspect block assembly components
3. Service piston and reassembly
4. Service crankshaft and bearing

# (TASK STATEMENT) F-1 DIAGNOSE ENGINE PROBLEMS (BLOCK)

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Universal oil pressure gauge
Compression gauge
Mechanics stethoscope
Chassis dynamometer
Cylinder leak tester

Engine block
Piston & rod assemblies
Crank-Shaft & bearings
Oil pump

## PERFORMANCE KNOWLEDGE

Check oil pressure
Check compression
Perform leak down test
Listen for noises
Dyno test

## SAFETY – HAZARD

Wear safety glasses
Beware of electric shock
Care of moving parts

Dirt or foreign material could fly in eye
With engine running, stethoscope may touch spark plug or wire
Running engine could catch loose clothing or long hair, etc

## DECISIONS

Determine if oil pressure is low
Determine if wet compression test is low
Determine if cylinder leakage is correct
Check noise level
Determine test results

## CUES

Low oil pressure
Abnormal noise
Poor performance

## ERRORS

Oil consumption
Critical engine damage.

## (TASK STATEMENT) F-1 DIAGNOSE ENGINE PROBLEMS (BLOCK)

### SCIENCE

Simple machines used to gain mechanical advantage Gears, levers, pulleys
Work input, work output friction and efficiency in simple machines Horse power output
Fluids under pressure Oil and fuel
Transfer of heat from one body to another From combustion chamber to water jackets
Effects of friction on work processes and product quality Power loss due to friction

The following principles of behavioral pattern should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Set of Real Numbers
- Rationals

Uses of Numbers (Without calculation)
- Compression Ratio

Basic Arithmetic Skills and Concepts
- Changing fractions to decimal and decimal to fractions Bore and crankshaft
- Rounding off decimals and whole numbers Crankshaft and camshaft

Basic Measurement Skills and Concepts
- Instruments Micrometer Tachometer
- Given an Instrument of Measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance Crankshaft and bore
- Metric and English measure and conversion
- Measurement Non-geometric
  - Liquid Oil pressure
  - [Pressure]

Basic Algebra Skills and Concepts
- Uses of variables
  - In formulas (cubic inch displacement)

Basic Logic
- Deductive inductive

Basic Geometry Skills and Concepts
- Determination of area and volume of cylinders

Fundamental Operations (Calculation)

Use of computing devices and mechanical aids
- Calculators
- Computers

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Complaint, Special checks | Terminology<br>Logic |
| Reading | Specification Chart, Test Gauges & Instruments | Comprehension<br>Terminology |
| Writing | Report Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks Fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape<br>Temperature |
| Smelling | Burned or contaminated oil | Engine oil odors |

(TASK STATEMENT) F-2 DISASSEMBLE, CLEAN AND INSPECT COMPONENT

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| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| S T K<br>Cleaning solvents<br>Ridge reamer<br><br>Block<br>Piston & rod assemblies<br>Crank shaft & bearings<br>Oil pump | Replace engine<br>Disassemble engine<br>Clean block & parts<br>Inspect components | Wear safety glasses<br>Fire extinguisher handy<br>Secure engine<br><br>Solvents or other foreign material may lodge in eye<br>Solvents or fuels are flamable<br>May fall and cause bodily injury |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine if it is necessary to remove the engine<br>Determine what parts are functional | Diagnosis shows need to remove<br>Cracked or broken parts<br>Worn parts | Engine damaged<br>Engine destroyed |

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## (TASK STATEMENT) F-2 DISASSEMBLE, CLEAN AND INSPECT COMPONENT

### SCIENCE

Simple machines used to gain mechanical advantage Gears, levers, pulleys
Work input, work output, friction and efficiency in simple machines Horse power output
Fluids under pressure Oil and fuel
Transfer of heat from one body to another From combustion chamber to water jackets
Effects of friction on work processes and product quality Power loss due to friction

The following principles of behavioral patterns should be included in this course

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real Numbers
- Rationals

Uses of Numbers (without calculation)
- Ratio Compression

Basic Arithmetic Skills and Concepts
- Changing fractions to decimal and decimal to fractions Bore and crankshaft
- Rounding off decimals and whole numbers Crankshaft and camshaft

Basic Measurement Skills and Concepts
- Instruments Micrometer tachometer
- Given an Instrument of Measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance Crankshaft and bore
- Metric and English measure and conversion
- Measurement: Non-geometric
  - Liquid Oil pressure
  - [Pressure]
- Reading and interpreting tables, charts, and graphs Torque spec charts

Basic Algebra Skills and Concepts
- Uses of variables
  - In formulas (Cubic inch displacement)

Basic Logic
- Deductive inductive

Basic Geometry Skills and Concepts
- Determination of area and volume of cylinders

Fundamental Operations (Calculation)

Use of computing devices and mechanical aids
- Calculators
- Computers

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint, Special checks | Terminology<br>Logic |
| Reading | Specification Chart, Test Gauges & Instruments | Comprehension<br>Terminology |
| Writing | Report Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape |
| Smelling | Burned or contaminated oil | Engine oil odors |

# (TASK STATEMENT) F-3 SERVICE PISTON AND ROD ASSEMBLY

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K.
Foot pound torque wrench
Ring groove cleaner
Thickness gauge
Ring installation tool

Pistons
Rods
Piston Pins
Rings

## PERFORMANCE KNOWLEDGE

Inspect pistons for cracks
Inspect piston ring groove for width wear
Inspect piston pins
Inspect rod alignment
Install rods and rings on pistons

## SAFETY – HAZARD

Wear safety glasses
Correct use of hand tools

Chips from ring groove tool
Sharp edges on pistons & rings

## DECISIONS

Determine if pistons are operable
See if piston pins are worn or locks are o k
Determine if rings will fit correctly
Determine that rods are not twisted or bent

## CUES

Cracked piston skirts
Worn ring grooves
Abnormal wear pattern on pistons

## ERRORS

Pistons cracked will destroy engine
Bent rods will knock

## (TASK STATEMENT) F-3 SERVICE PISTON AND ROD ASSEMBLY

### SCIENCE

Simple machines used to gain mechanical advantage  Gears, levers, pulleys
Work input, work output, friction and efficiency in simple machine  Horse power output
Fluids under pressure  Oil and fuel
Transfer of heat from one body to another  From combustion chamber to water jackets
Effects of friction on work processes and product quality  Power loss due to friction

The following principles of behavioral patterns should be included:

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Set of Real Numbers
- Rationals

Uses of Numbers (Without calculation)
- Compression Ratio

Basic Arithmetic Skills and Concepts
- Changing fractions to decimal and decimal to fractions  Bore and crankshaft
- Rounding off decimals and whole numbers  Crankshaft and camshaft

Basic Measurement Skills and Concepts
- Instruments  Micrometer  Tachometer
- Given an Instrument of Measure, determine precision and or accuracy with respect to relative error, significant digits and tolerance  Crankshaft and bore
- Metric and English measure and conversion
- Measurement  Non-geometric
  - Liquid  Oil pressure
  - [Pressure]

Basic Algebra Skills and Concepts
- Uses of variables
  - In formulas (cubic inch displacement)

Basic Logic
- Deductive inductive

Basic Geometry Skills and Concepts
- Determination of area and volume of cylinders

Fundamental Operations (Calculation)

Use of computing devices and mechanical aids
- Calculators
- Computers

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Torque Specification charts
- Instruments  Thickness gauge
- Given an Instrument of Measure, determine precision and, or accuracy with respect to relative error, significant digits, and tolerance  Tolerance, clearance, piston skirt

Uses of Numbers (Without calculation)
- Coding, Coding  bit sizing

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint, Special checks | Terminology<br>Logic |
| Reading | Specification chart, Test gauges & Instruments | Comprehension<br>Terminology |
| Writing | Report – Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks  fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape |
| Smelling | Burned or contaminated oil | Engine oil odors |

# (TASK STATEMENT) F-4 SERVICE CRANKSHAFT AND BEARINGS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Torque wrench
Plastigauge
Micrometers
Rear oil seal installer

Engine block
Crankshaft
Bearings

## PERFORMANCE KNOWLEDGE

Keep main and rod caps in order
Install rear main oil seal
Use micrometers, check crankshaft
Inspect bearing clearance with plastiguage
Torque rod and main bearings to specification

## SAFETY – HAZARD

Wear safety glasses
Make sure engine block is secure

Keep foreign material out of eyes
Engine could drop or roll on hands or feet

## DECISIONS

Determine if the crankshaft will operate correctly with new bearings

## CUES

Crank measures undersize
Crank has taper or is out of round
Crank has too much end play

## ERRORS

Engine will not last
Rods or mains will knock
Engine could tie up
Could ruin engine

## ASK STATEMENT) F-4 SERVICE CRANKSHAFT AND BEARINGS

### SCIENCE

Simple machines used to gain mechanical advantage Gears, levers, pulleys
Work input, work output, friction and efficiency in simple machines Horse power output
Fluids under pressure Oil and fuel
Transfer of heat from one body to another From combustion chamber to water jackets
Effects of friction on work processes and product quality Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc.
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real Numbers
- Rationals

Uses of Numbers (Without calculation)
- Compression Ratio

Basic Arithmetic Skills and Concepts
- Changing fractions to decimal and decimal to fractions Bore and crankshaft
- Rounding off decimals and whole numbers Crankshaft and camshaft

Basic Measurement Skills and Concepts
- Instruments Micrometer Tachometer
- Given an Instrument of Measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance Crankshaft and bore
- Metric and English measure and conversion
- Measurement: Non-geometric
  - Liquid Oil pressure
  - [Pressure]

Basic Algebra Skills and Concepts
- Uses of variables
  - In formulas (cubic inch displacement)

Basic Logic
- Deductive inductive

Basic Geometry Skills and Concepts
- Determination of area and volume of cylinders

Fundamental Operations (Calculation)

Use of computing devices and mechanical aids
- Calculators
- Computers

Basic Measurement Skills and Concepts
- Instruments– Plastiguage
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance –Oil

Uses of Numbers (Without calculation)
- Coding

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint, special checks | Terminology<br>Logic |
| Reading | Specification chart, Test gauges & Instruments | Comprehension<br>Terminology |
| Writin | Report– cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape |
| Smelling | Burned or contaminated oil | Engine oil odors |



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## DUTY G. SERVICING AND REPAIRING VALVE TRAINS

1. Diagnose valve train problems
2. Service valve train components

# (TASK STATEMENT) G-1 DIAGNOSE VALVE TRAIN PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Oil pressure gauge
Compression gauge
Stethoscope
Cylinder leak down test

Valves
Cylinder heads
Rocker arms
Push arms
Push rods
Lifters
Camshaft
Timing chain
Timing gears

## PERFORMANCE KNOWLEDGE

Check oil pressure with gauge
Check compression
Run cylinder leak down test
Test timing chain
Visually check rocker arm assembly

## SAFETY – HAZARD

Use safety glasses
Keep loose clothing or long hair away from cranking engine

Foreign material in eyes
Moving parts may catch hair or loose clothing

## DECISIONS

Determine that the problem is not oil pressure
Determine if compression is faulty
Determine if the fault is rings or valves
Determine that the timing chain is correct
Determine if the rocker assembly is in place and operable

## CUES

Noisy lifters
Low reading on compression gauge
Air leak at carburetor, exhaust pipe, or oil hose
Low compression on all cylinders
Broken or misplaced rocker assembly

## ERRORS

Engine will not run
Engine will miss
Poor performance
Poor mileage

## ASK STATEMENT) G-1 DIAGNOSE VALVE TRAIN PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage Gears, levers, pulleys
Work input, work output friction and efficiency in simple machines Horse power output
Fluids under pressure Oil and fuel
Transfer of heat from one body to another From combustion chamber to water jackets
Effects of friction on work processes and product quality Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real Numbers
- Rationals

Uses of Numbers (Without calculation)
- Compression Ratio

Basic Arithmetic Skills and Concepts
- Changing fractions to decimal and decimal to fractions Bore and crankshaft
- Rounding off decimals and whole numbers Crankshaft and camshaft

Basic Measurement Skills and Concepts
- Instruments Micrometer Tachometer
- Given an Instrument of Measure, determine precision and or accuracy with respect to relative error significant digits, and tolerance Crankshaft and bore
- Metric and English measure and conversion
- Measurement Non-geometric
  - Liquid Oil pressure
  - [Pressure]

Basic Algebra Skills and Concepts
- Uses of variables
  - In formulas (cubic inch displacement)

Basic Logic
- Deductive inductive

Basic Geometry Skills and Concepts
- Determination of area and volume of cylinders

Fundamental Operations (Calculation)

Use of computing devices and mechanical aids
- Calculators
- Computers

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint, Special checks | Terminology<br>Logic |
| Reading | Specification chart, Test gauges & Instruments | Comprehension<br>Terminology |
| Writing | Report-Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape |
| Smelling | Burned or contaminated oil | Engine oil odors |

# (TASK STATEMENT) G-2 SERVICE VALVE TRAIN COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Cleaning Solvents
Valve spring compressor
Valve face grinder
Valve seat grinder
Spring tension gauge
Dampener puller

Valves
Cylinder heads
Rocker arms
Push rods
Lifters
Camshaft
Timing chain
Timing gears

## PERFORMANCE KNOWLEDGE

Face valves
Seat heads
Clean and surface rocker arms
Service lifters
Check camshaft lobe lift
Set timing chain and gears to specification

## SAFETY – HAZARD

Wear safety glasses
Wear face shield

Foreign material in eyes
Grinder emery dust is hazardous

## DECISIONS

Determine that the valves will operate correctly
See that the timing chain is installed correctly
Determine that the lifters are not at fault

## CUES

Check valves with blueing or like substance
Lifters are sticking or varnished badly

## ERRORS

Engine will miss
Valves will be noisy
Engine will not start

G-2

# (TASK STATEMENT) G-2 SERVICE VALVE TRAIN COMPONENTS

## SCIENCE

Simple machines used to gain mechanical advantage  Gears, levers at 3 pulleys
Work input, work output, friction and efficiency in simple machines  Foot and inch pound of torque
Fluids under pressure  Oil pressure
Transfer of heat from one body to another  Heat of combustion
Effects of friction on work processes and product quality  Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

- Set of Real Numbers
  - Rationals
- Uses of Numbers (Without calculation)
  - Compression Ratio
- Basic Arithmetic Skills and Concepts
  - Changing fractions to decimal and decimal to fractions  Bore and crankshaft
  - Rounding off decimals and whole numbers  Crankshaft and camshaft
- Basic Measurement Skills and Concepts
  - Instruments  Micrometer  Tachometer
  - Given an Instrument of Measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance  Crankshaft and bore
  - Metric and English measure and conversion
  - Measurement Non-geometric
    - Liquid  Oil pressure
    - [Pressure]
- Basic Algebra Skills and Concepts
  - Uses of variables
    - In formulas (cubic inch displacement)
- Basic Logic
  - Deductive inductive
- Basic Geometry Skills and Concepts
  - Determination of area and volume of cylinders
- Fundamental Operations (Calculation)
- Use of computing devices and mechanical aids
  - Calculators
  - Computers

- Basic Measurement Skills and concepts
  - Measurement Geometric
    - Angle

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint, Special checks | Terminology<br>Logic |
| Reading | Specification chart, Test gauges & Instruments | Comprehension<br>Terminology |
| Writing | Report-Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Squeaks, knocks, rattles | Auditory discrimination |
| Viewing | Oil leaks  fuel leaks | Visual analysis<br>Symbols and codes |
| Touching | Rough or worn parts | Size<br>Shape |
| Smelling | Burned or contaminated oil | Engine oil odors |

## DUTY H. SERVICING AND REPAIRING IGNITION SYSTEMS

1. Diagnose ignition system problems
2. Service ignition systems components
3. Service and repair electronic ignition systems

# (TASK STATEMENT) H-1 DIAGNOSE INGNITION SYSTEM PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Oscilloscope
Tach-dwell meter
Timing light
Distributor strobe
Vacuum Gauge
Combustion analyzer
S T K

Spark Plugs
Ignition wires
Distributor
Coil
Resistor
Ignition switch
Points
Condensor

## PERFORMANCE KNOWLEDGE

Hook up oscilloscope assembly
Run unit tests
Analyze results

## SAFETY – HAZARD

Wear safety glasses
Do not wear loose fitting clothing
Keep test wires and instruments clear of engine moving parts
Beware of shock from wires

Keep foreign object out of eyes
Loose fitting clothes or long hair could catch in moving machinery
Test wires or cables could catch in machinery
Electric shock can be dangerous

## DECISIONS

Determine system problem
Determine needed repair

## CUES

Pattern of scope oscillations
Engine performance

## ERRORS

Poor performance
Poor or no start
Poor mileage

## (ASK STATEMENT) H-1 DIAGNOSE IGNITION SYSTEM PROBLEMS

### SCIENCE

Resistance of materials to flow of electrical current — Resistance wire
Magnetic fields of force — Ignition coil

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Set of Real numbers — Rationals
Uses of Numbers (Without calculation)
- Indexing
- Timing

Fundamental Operations (Calculations)
Basic Arithmetic Skills and Concepts
- Ratio and proportion

Basic Measurement Skills and Concepts
- Instruments — Tach-dwell timing light Scope etc
- Measurement Geometric
  - Angle dwell
- Reading and interpreting tables charts, and graphs
  - Logs-Tune up specifications

Basic Logic
- Deductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Specification chart | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Engine miss roughness | Auditory Discrimination<br>Logic |
| Viewing | Spec chart symbols<br>Wiring diagram | Visual analysis<br>Logic<br>Symbols, codes |
| Touching | Electric shock | Safety |

# (TASK STATEMENT) H-2 SERVICE IGNITION SYSTEMS COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Spark plug cleaner
Ohm meter
Distributor strobe
Timing light
Tach-dwell meter
Oscilloscope

Spark pluhs
Ignition wires
Distributor
Coil
Resistor
Points
Condensor
Ignition switch

## PERFORMANCE KNOWLEDGE

Remove and install necessary pa[illegible]s
Set distributor on distributor strobe
Retest on oscilloscope assembly
Adjust to specifications per test results

## SAFETY — HAZARD

Wear safety glasses
Do not wear loose fitting clothing
Keep test wires and instruments clear of engine moving parts
Beware of shock from wires

Keep foreign object out of eyes
Loose fitting clothes or long hair could catch in moving engine parts
Test wires or cables could catch in engine parts
Electric shock can be dangerous

## DECISIONS

Determine from retest results if the ignition system now functions properly

## CUES

Poor starting
Rough idle
Poor performance

## ERRORS

Results in poor performance
Possible breakdown
Poor mileage

## (TASK STATEMENT) H-2 SERVICE IGNITION SYSTEMS COMPONENTS

### SCIENCE

Resistance of materials to flow of electrical current  Resistance wire
Magnetic fields of force  Ignition coil

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Uses of Numbers (Without calculation)
- Indexing
- Timing

Fundamental Operations (Calculations)
Basic Arithmetic Skills and Concepts
- Ratio and proportion

Basic Measurement Skills and Concepts
- Instruments  Tach-dwell timing light  Scope etc
- Measurement  Geometric
  - Angle dwell
- Reading and interpreting tables, charts, and graphs
  - Logs-Tune up specifications

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments  Ohm meter

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Specification chart | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Engine miss- roughness | Auditory Discrimination<br>Logic |
| Viewing | Spec chart symbols<br>Wiring diagram | Visual analysis<br>Logic<br>Symbols, codes |
| Touching | Electric shock | Safety |

# (TASK STATEMENT) H-3 SERVICE AND REPAIR ELECTRONIC IGNITION SYSTEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Electronic test instruments
Ohm meter
S T K
Volt meter
Amp meter

Magnetic impulse distributor
Amplifier
Resistor
Ignition coil

## PERFORMANCE KNOWLEDGE

Test distributor on strobe instrument
Test pulse amplifier
Test resistor
Test ignition coil

## SAFETY – HAZARD

Wear safety glasses
Beware of high voltage
Beware of moving parts

May get foreign material in eyes
High voltage is dangerous
Moving parts may catch loose clothing

## DECISIONS

Determine which part or parts are functioning correctly

## CUES

Engine not running
Determine if test results agree with specification manuals

## ERRORS

Road breakdown
Hard start
Poor performance

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# TASK STATEMENT) H-3 SERVICE AND REPAIR ELECTRONIC IGNITION SYSTEMS

## SCIENCE

Resistance of materials to flow of electrical current  Resistance wire
Magnetic fields of force  Ignition coil

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative Venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Uses of Numbers (Without calculation)
- Indexing
- Timing

Fundamental Operations (Calculations)
Basic Arithmetic Skills and Concepts
- Ratio and proportion

Basic Measurement Skills and Concepts
- Instruments  Tach-dwell timing light Scope etc
- Measurement Geometric
  - Angle dwell
- Reading and interpreting tables, charts and graphs
  - Logs-Tune up specifications

Basic Logic
- Deductive

Basic Measurement Skills and concepts
- Instruments  Voltmeter, ampmeter

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Specification chart | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Engine miss  roughness | Auditory Discrimination<br>Logic |
| Viewing | Spec chart symbols<br>Wiring diagram | Visual analysis<br>Logic<br>Symbols, codes |
| Touching | Electric Shock | Safety |

## DUTY I: SERVICING AND REPAIRING BRAKING SYSTEMS (DRUM TYPE)

1. Diagnose brake system problems (drum type)
2. Overhaul brake components, adjust and bleed
3. Test and repair power brake units

# (TASK STATEMENT) I-1 DIAGNOSE BRAKE SYSTEM PROBLEMS (DRUM TYPE)

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Dynomometer
Brake pressure bleeder

Brake drums
Brake shoes
Park brake cables and levers
Lines and hoses
Wheel and master cylinders
Spring and brake linkeage

## PERFORMANCE KNOWLEDGE

Dyno test brake effeciency
Visual inspection
Performance test

## SAFETY – HAZARD

Wear safety glasses
Keep brake fluid off hand and body
Support car on safety stands

Keep foreign-material out of eyes
Brake fluid causes irritation
Hydraulic jacks are not safe

## DECISIONS

Determine Dyno test results
Determine if all components pass visual inspection
Determine if brakes are in safe operating condition

## CUES

Dyno test shows poor brake effeciency
Brake cylinders are leaking
Brake shoes are worn or broken

## ERRORS

Brake failure
Brakes pull or fade
Poor or spongy brake pedal

## TASK STATEMENT) I-1 DIAGNOSE BRAKE SYSTEM PROBLEMS (DRUM TYPE)

### SCIENCE

Simple machines used to gain mechanical advantage Levers
Work input work output friction and efficiency in simple machines Parking brake cables
Effect of heating and cooling on expansion of materials Brake fade
Fluids under pressure Master cylinder and wheel cylinder
Transfer of heat from one body to another Lining to drum
Effects of friction on work processes and product quality Brake fade

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of real numbers
- Rationals

Fundamental Operations

Basic Arithmetic Skills and Concepts
- Ratio

Use of computing devices and mechanical aids
Computers Dyno
Basic Measurement Skills and Concepts
- Instruments Pressure bleeder

Basic Logic
- Deductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test result, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Grinding squeaks squeals, scraping<br>Fluid leaks seepage | Auditory discrimination<br>Logic |
| Viewing | | Visual analysis<br>Symbols codes |
| Touching | Heat | Size<br>Shape<br>Temperature |
| Smelling | Fluid odor, Burning brake lining | Odor burning brake lining |

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# (TASK STATEMENT) I-2 OVERHAUL BRAKE COMPONENTS, ADJUST AND BLEED

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Brake bleeder
Wheel cylinder hone
Brake drum lathe
Special brake tools

Brake drums
Brake shoes
Brake cables
Wheel cylinders
Master cylinders
Brake springs and linkeage

## PERFORMANCE KNOWLEDGE

Remove and replace wheels, brake drums and shoes
Remove, replace and or overhaul wheel cylinders
Remove, replace and or overhaul master cylinder
Replace brake shoes and springs as necessary
Bleed and adjust system
Dyno test

## SAFETY – HAZARD

Wear safety glasses
Support car with safety stands
Make sure brake has sufficient pedal to safely stop car before test

May get foreign object in eye
Car may slip off jack
Would damage car or cause accident

## DECISIONS

Determine if the job will meet safe operating conditions

## CUES

Spongy pedal
Brake pull (right or left)
Pedal low
Brake fade

## ERRORS

Brake failure
Strong possibility of accident
Auto damaged or destroyed
Driver hurt or killed

## (TASK STATEMENT) I-2 OVERHAUL BRAKE COMPONENTS, ADJUST AND BLEED

### SCIENCE

Simple machines used to gain mechanical advantage  Levers
Work input  work output  friction and effeciency in simple machines  Parking brake cables
Effect of heating and cooling on expansion of materials  Brake fade
Fluids under pressure  Master cylinder and wheel cylinder
Transfer of heat from one body to another  Lining to drum
Effects of friction on work processes and product quality  Brake fade

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment  etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of real numbers
- Rational

Fundamental Operations (Calculation)

Basic Measurement Skills and Concepts
- Instruments  Wheel cylinder hown
- Metric and English measure and conversion
- Measurement Geometric
  - Volume  Cylinder bore
- Measurement Non-geometric
  - Liquid  Brake fluid
- Reading and Interpreting tables, charts and graphs
  - Logs  Spec charts

Use of computing devices and mechanical aids
- Computers  Dyno

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec charts | Comprehension<br>Terminology |
| Writing | Test result, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Grinding, squeaks squeals, scraping | Auditory discrimination<br>Logic |
| Viewing | Fluid leaks  seepage | Visual analysis<br>Symbols, codes |
| Touching | Heat | Size<br>Shape<br>Temperature |
| Smelling | Fluid odor, Burning brake lining | Odor burning brake lining |

TASK STATEMENT) **I-3 TEST AND REPAIR POWER BRAKE UNITS**

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S T K
Vacuum gauge

Power brake unit

## PERFORMANCE KNOWLEDGE

Test power unit
Remove, replace or repair
Check for brake fluid in power unit

## SAFETY – HAZARD

Wear safety glasses
Block or support car

Keep foreign material out of eyes such as brake fluid
Car may move

## DECISIONS

Determine if the unit is malfunctioning
Determine if unit is repairable
Determine if master cylinder is leaking fluid into unit

## CUES

Hard pedal
Vacuum leak
Unit sticking

## ERRORS

Stiff working pedal
Brakes will not release easily

## (TASK STATEMENT) I-3 TEST AND REPAIR POWER BRAKE UNITS

### SCIENCE

Simple machines used to gain mechanical advantage  Vacuum operated levers
Work input  work output, friction and efficiency in simple machines  Torque step up from booster

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment  etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real numbers
- Rationals

Fundamental Operations (Calculation)
Basic Measurement Skills and Concepts
- Instruments  Vacuum gauge
- Measurement  Geometric
  - Volume
- Reading and interpreting tables, charts, and graphs
  - Logs  Spec charts

Basic Logic
- Deductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec. charts | Comprehension<br>Terminology |
| Writing | Test result, Cost estimate | Penmanship<br>Spelling<br>Terminology<br>Logic |
| Listening | Grinding, squeaks, squeals  scraping | Auditory discrimination |
| Viewing | Fluid leaks  seepage | Visual analysis<br>Symbols and codes |
| Touching | Heat | Size<br>Shape |
| Smelling | Fluid odor, Burning brake lining | Engine oil odors |

## DUTY J. SERVICING AND REPAIRING BRAKING SYSTEMS (DISC TYPE)

1. Diagnose disc brake problems
2. Service disc brake components

(TASK STATEMENT) **J-1 DIAGNOSE DISC BRAKE PROBLEMS**

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Dynomometer
S T K
Brake tool kit

Calipers
Pads
Rotors
Control valves
Front wheel bearings

## PERFORMANCE KNOWLEDGE

Dyno test brake efficiency
Visual inspection
Performance test

## SAFETY – HAZARD

Wear safety glasses
Observe safety rules in use of dynomometer
Use sound judgment on performance test

Foreign objects
High speed or power operation
Possible poor b[illegible] conditions

## DECISIONS

Determine need and extent of repair

## CUES

Worn brake pads
Damaged or g[illegible]ooved rotor
Pulsing pedal
Loose front wheel bearings

## ERRORS

Dangerous condition of poor operating brakes
Damage to car or driver or both
Needless expensive repairs

# (TASK STATEMENT) J-1 DIAGNOSE DISC BRAKE PROBLEMS

## SCIENCE

Simple machines used to gain mechanical advantage Levers
Work input work output friction and efficiency in simple machines Parking brake cables
Effect of heating and cooling on expansion of materials Brake fade
Fluids under pressure Master cylinder and calipers
Transfer of heat from one body to another Pad to rotor
Effects of friction on work processes and product quality Brake fade

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers Rationals
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers Dyno

Basic Measurement Skills and Concepts
- Reading and interpreting tables charts and graphs
  - Logs Spec charts

Basic Logic
- Deductive

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Grinding, squeaks, squeals, scraping | Auditory discrimination<br>Logic |
| Viewing | Fluid leaks seepage | Visual analysis<br>Symbols, codes |
| Touching | Heat | Size<br>Shape<br>Temperature |
| Smelling | Fluid odor, burning brake lining | Odor burning brake lining |

## (TASK STATEMENT) J-2 SERVICE DISC BRAKE COMPONENTS

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S I K
Safety stands
Brake tool kit
Brake fluid

Caliper assembly
Pads
Rotors
Control valves

### PERFORMANCE KNOWLEDGE

Remove and replace components
Overhaul calipers
Turn rotors
Clean and check control valves

### SAFETY – HAZARD

Wear safety glasses
Double check all work
Use safety stands

Foreign objects could damage eyes
Life depends on good brakes
Car could come down on worker

### DECISIONS

Determine if rotors will turn and remain in specifications
Determine if calipers are scored or cracked
Determine if control valves are operable

### CUES

Rotors scored deeply
Brake pedal pulses

### ERRORS

Dangerous brake failure
Damage to car and occupants

# (TASK STATEMENT) J-2 SERVICE DISC BRAKE COMPONENTS

## SCIENCE

Simple machines used to gain mechanical advantage  Levers
Work input  work output  friction and efficiency in simple machines  Parking brake cables
Effect of heating and cooling on expansion of materials  Brake fade
Fluids under pressure  Master cylinder and calipers
Transfer of heat from one body to another  Pad to rotor
Effects of friction on work processes and product quality  Brake fade

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers  Dyno

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs  Spec charts

Basic Logic
- Deductive

Basic measurement Skills and Concepts
- Metric and English measure and conversion
- Measurement  Geometric
  - Area  Rotor
- Instruments  Micrometer
- Measurements  Non-geometric
  - Speed  Stopping distance

Basic Logic
- Deductive

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Logic |
| Listening | Grinding, squeaks, squeals, scraping | Auditory discrimination<br>Logic |
| Viewing | Fluid leaks  seepage | Visual analysis<br>Symbols, codes |
| Touching | Heat | Size<br>Shape<br>Temperature |
| Smelling | Fluid odor, burning brake lining | Odor burning brake lining |

## DUTY K. SERVICING AND REPAIRING STEEIRNG UNITS

1. Diagnose steering system problems
2. Service manual steering components
3. Service power steering components

# (TASK STATEMENT) K-1 DIAGNOSE STEERING SYSTEM PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Front end alignment unit
S T K
Dynomometer

Steering gear
Wheels
Ball joints
Tie rod ends
Idler arms
Upper and lower control arms
Power steering units

## PERFORMANCE KNOWLEDGE

Dynomometer test
Alignment check
Lower control arm check
Ball joint and tie rod check
Check power steering units

## SAFETY – HAZARD

Safety glasses
Clothing and hair may get caught in moving parts

## DECISIONS

Determine what unit or units are at fault
Determine if it is alignment only

Determine if power unit is at fault

## CUES

Uneven tire wear
Wear or scuff gauge
Dyno test results
Loose units

## ERRORS

Tire wear
Accidents
Road failure

## (TASK STATEMENT) K-1 DIAGNOSE STEERING SYSTEM PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage  Gears, levers
Work input  work output  friction and efficiency in simple machines  Steering gear box
Motion resulting from two or more forces acting on a point in a body  Force vs Resistance

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Uses of numbers (Without calculation)
- Ratio  Gear box

Fundamental Operations (Calculation)
Basic Arithmetic Skills and Concepts
- Reduction of fractions  Alignment spec

Use of computing devices and mechanical aids
- Computers  Dyno

Basic Measurement Skills and Concepts
- Instruments  Alignment rack
- Measurement  Geometric
  - Area  Angle (caster)

Basic Logic
- Deductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmenship<br>Spelling<br>Terminology<br>Logic |
| Listening | Knock, rattle, squealing tire | Auditory discrimination<br>Logic |
| Viewing | Featheredge, uneven wear | Visual analysis<br>Logic<br>Symbols |
| Touching | Featheredge | Consistency |

# (TASK STATEMENT) K-2 SERVICING MANUAL STEERING COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S I K
Manual Steering Unit
Puller set
Bushing drivers
Bearing press

Steering column

Worn gear
Sector
Bearing
Bushing
Seals
Gaskets

## PERFORMANCE KNOWLEDGE

Remove, disassemble, clean and inspect
Replace defective parts, reassemble, adjust and replace in car

## SAFETY – HAZARD

Wear safety glasses
Double check all work

Foreign material may get in eyes
Life depends on good steering

## DECISIONS

Determine how to remove and what is the problem
Determine which parts are defective

## CUES

Loose steering gear
Catch in steering
Hard to steer

## ERRORS

Accidents
Road failure
Tire wear

# TASK STATEMENT) K-2 SERVICING MANUAL STEERING COMPONENTS

## SCIENCE

Simple machines used to gain mechanical advantage  Gears, levers
Work input, work output  friction and efficiency in simple machines  Steering gear box
Motion resulting from two or more forces acting on a point in a body  Force vs Resistance

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Uses of numbers (Without calculation)
- Ratio  Gear box

Fundamental Operations (Calculation)
Basic Arithmetic Skills and Concepts
- Reduction of fractions  Alignment spec

Use of computing devices and mechanical aids
- Computers  Dyno

Basic Measurement Skills and Concepts
- Instruments  Alignment rack
- Measurement  Geometric
  - Area  Angle (caster)

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Logs  Spec charts

Basic Arithmetic Skills and concepts
- Properties of the real number system
  - Identity of zero (+)

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmenship<br>Spelling<br>Terminology<br>Logic |
| Listening | Knock, rattle, squealing tire | Auditory discrimination<br>Logic |
| Viewing | Featheredge, uneven wear | Visual analysis<br>Logic<br>Symbols |
| Touching | Featheredge | Consistency |

# (TASK STATEMENT) K-3 SERVICE POWER STEERING COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S I K
Puller set
Seal drivers
Bushing drivers
Pressure gauge

Power steering pumps
Power steering gear boxes

## PERFORMANCE KNOWLEDGE

Test, remove, disassemble and inspect
Replace necessary parts, reassemble, adjust and test

## SAFETY – HAZARD

Wear safety glasses
Beware of oil under pressure hazard

May get dirt or oil in eyes
Line may break under pressure

## DECISIONS

Determine from test results what has failed
Determine from inspection what parts to replace

## CUES

Noises
Erratic steering
Loss of power steering

## ERRORS

Fluid leaks
Improper steering
Loss of power

## TASK STATEMENT) K-3 SERVICE POWER STEERING COMPONENTS

### SCIENCE

Simple machines used to gain mechanical advantage  Steering gear box
Work input, work output, friction and effeiency in simple machines  Pump
Fluids under pressure  Pump

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Uses of numbers (Without calculation)
- Ratio  Gear box

Fundamental Operations (Calculation)
Basic Arithmetic Skills and Concepts
- Reduction of fractions  Alignment spec

Use of computing devices and mechanical aids
- Computers  Dyno

Basic Measurement Skills and Concepts
- Instruments  Alignment rack
- Measurement: Geometric
  - Area  Angle (caster)

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments  Oil pressure gauge
- Measurement: Geometric
  - Volume  Oil
- Measurement: Non-geometric
  - Liquid
- Reading and interpreting tables, charts, and graphs
  - Logs

Basic Arithmetic Skills and Concepts
- Properties of the real number system
  - Identity of zero (+)

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmenship<br>Spelling<br>Terminology<br>Logic |
| Listening | Knock, rattle, squealing tire, belt slip | Auditory discrimination<br>Logic |
| Viewing | F theredge, uneven wear, belt loose, fluid leaks | Visual analysis<br>Logic<br>Symbols |
| Touching | Belt tension | Movement |

## DUTY L. REPAIRING AND ALIGNING FRONT END ASSEMBLIES

1. Diagnose front end problems
2. Service front end components

(TASK STATEMENT) **L-1 DIAGNOSE FRONT END PROBLEMS**

R1

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Alignment rack<br>Wheel balancer<br>Dynomometer<br><br>Upper and lower control arms<br>Ball joints<br>Tie rod end and linkage<br>Wheel bearings<br>Spindels | Dyno test<br>Visual inspection<br>Performance test | Wear safety glasses<br>Loose clothing and long hair<br><br>Foreign material may get into eyes<br>Loose clothing or long hair may catch in moving parts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine results of Dyno test<br>Determine from visual inspection in front end components are safe<br>Test drive and check problems | Tire wear<br>Shimmy<br>Too much play in steering | Accidents<br>Tire wear<br>Road failure |

(TASK STATEMENT) **L-1 DIAGNOSE FRONT END PROBLEMS**

## SCIENCE

Simple machines used to gain mechanical advantage  Steering linkage
Work input, work output, friction and efficiency in simple machines  Steering box
Motion resulting from two or more forces acting on a point in a body  Force vs Resistance

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Use of computing devices and mechanical aids
- Computers  Dyno

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments  Alignment rack

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec. Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Reports<br>Terminology<br>Clarity of expression |
| Listening | Knock, rattle, squealing tire | Auditory discrimination<br>Noise discrimination |
| Viewing | Featheredge, uneven wear | Visual analysis<br>Recognition of symbols |

(TASK STATEMENT) **L-2 SERVICE FRONT END COMPONENTS**

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Alignment rack
Puller set
Special tool as required

Front end alignment
Upper and lower control arms
Ball joints
Tie rod ends and linkage
Wheel bearings
Bushings
Spindels

## PERFORMANCE KNOWLEDGE

Repair defective parts
Check tire wear patterns
Remove and replace defective parts
Align front end

## SAFETY – HAZARD

Wear safety glasses
Support car properly for type of repair you are doing

May get foreign object in eye
Car may slip off jack and cause accident or damage to car

## DECISIONS

Determine what parts are defective
Determine how to remove and replace defective parts
Determine from tire wear pattern what the problems are
Determine if alignment is within specifications

## CUES

Tire wear
Shimmy
Loose steering

## ERRORS

Accidents
Tire wear
Road failure

TASK (STATEMENT) **L-2 SERVICE FRONT END COMPONENTS**

## SCIENCE

Simple machines used to gain mechanical advantage  Steering linkage
Work input, work output, friction and efficiency in simple machines  Steering box
Motion resulting from two or more forces acting on a point in a body  Force vs Resistance

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc.
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rationals
Use of computing devices and mechanical aids
- Computers  Dyno

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments  Alignment rack

Basic logic
- Deductive

Basic Measurement Skills and Concepts
- Measurement  Geometric
  - Angle
- Metric measure and conversion
- Reading and interpreting tables, charts, and graphs
  - Logs-Alignment charts

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer Information | Terminology<br>Logic |
| Reading | Spec. Charts | Comprehension<br>Terminology |
| Writing | Test results, Cost estimate | Penmanship<br>Spelling<br>Reports<br>Terminology<br>Clarity of expression |
| Listening | Knock, rattle, squealing tire | Auditory discrimination<br>Noise discrimination |
| Viewing | Featheredge, uneven wear | Visual analysis<br>Recognition of symbols |

## DUTY M. REPAIRING REAR AXLE AND DRIVE LINE

1. Diagnose rear axle and drive line problems
2. Service rear axle components

# (TASK STATEMENT) M-1 DIAGNOSE REAR AXLE AND DRIVE LINE PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Dynomometer
S I K
Stethoscope
Protractor and level

Rear axle assembly
Drive line components

## PERFORMANCE KNOWLEDGE

Dynomometer test
Check noise with stethoscope
Check drive line angle

## SAFETY – HAZARD

Wear safety glasses
Watch for moving parts

Foreign material in eye
Clothing or long hair may catch in moving parts

## DECISIONS

Determine Dyno test results
Determine what is making noise with stethoscope
Determine if drive line angles are within specifications

## CUES

Rear end noise
Vibration

## ERRORS

Road failure
Vibrations and noise

## (TASK STATEMENT) M-1 DIAGNOSE REAR AXLE AND DRIVE LINE PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage - Gears
Work input, work output friction and efficiency in simple machines - Applied force
Centrifugal forces developed by bodies in rotation - Drive line
Effects of friction on work processes and product quality - Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set - Real numbers - Rational
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers - Dyno

Basic Measurement Skills and Concepts
- Instruments - Stethoscope protractor level (Nose angle)

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Measurement - Non-geometric
- Speed (R P M) (M P H) N H V

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Spec chart | Comprehension<br>Terminology |
| Writing | Test result, cost estimate | Penmanship<br>Spelling<br>Terminology<br>Process report (instruction) |
| Listening | Noise level - Pitch | Auditory discrimination<br>Logic |
| Viewing | Loose U joints | Visual analysis<br>Detail and inference<br>Symbols & codes |
| Touching | Car vibration | Vibration |

# (TASK STATEMENT) M-2 SERVICE REAR AXLE COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.I.K.
Special tools for type of rear axle servicing
Micrometer
U joint clamps
Rear axle stand

Rear axle assembly
Axle bearing
U joints
Slip joints
Carrier bearing

## PERFORMANCE KNOWLEDGE

Disassemble, clean and inspect rear axle assemblies and drive line components
Repair or replace and adjust defective parts
Assemble, adjust and test rear axles and or drive line components

## SAFETY — HAZARD

Wear safety glasses
Mounting of rear axle in stand

May get foreign material in eye
Loose mounting may cause accident or damage to rear axle assemblies

## DECISIONS

Determine from inspection what parts are defective
Determine from special manual how to replace and adjust replacement parts
Determine from road test or dyno test if repairs meet manual specifications

## CUES

Rear axle or drive line noise
Vibration from drive line or rear axle

## ERRORS

Road failure
Vibration and or rear end noise

# (TASK STATEMENT) M-2 SERVICE REAR AXLE COMPONENTS

## SCIENCE

Simple machines used to gain mechanical advantage  Gears
Work input, work output, friction and efficiency in simple machines  Applied force
Centrifugal forces developed by bodies in rotation  Drive line
Effects of friction on work processes and product quality  Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH – NUMBER SYSTEMS

Set of Real numbers  Rational
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers  Dyno

Basic Measurement Skills and Concepts
- Instruments  Stethoscope, protractor level (Nose angle)

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Measurement  Non-geometric
  - Speed (R.P.M.) (M.P.H.) N.H.V.

Basic Measurement Skills and Concepts
- Instrument  Micrometer
- Metric measure and conversion
- Measurement  Geometric
  - Angle  Nose
- Reading and interpreting tables, charts, and graphs
  - Logs  Rear end and drive line charts
- Measurement  Geometric
  - Linear

Basic Arithmetic Skills and Concepts
- Ratio and Proportion  Gear

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Spec. chart | Comprehension<br>Terminology |
| Writing | Test result, cost estimate | Penmanship<br>Spelling<br>Terminology<br>Process report (instruction) |
| Listening | Noise level  pitch | Auditory discrimination<br>Logic |
| Viewing | Loose U joints | Visual analysis<br>Detail and inference<br>Symbols & codes |
| Touching | Car Vibration | Vibration |

## DUTY N. REPAIRING TRANSMISSIONS (STANDARD)

1. Diagnose transmission problems (STD)
2. Service transmission components and repair

## (TASK STATEMENT) N-1 DIAGNOSE TRANSMISSION PROBLEMS (STD)

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| S T K<br>Stethoscope<br>Dynomometer or road test<br><br>Transmission (STD)<br>Shift linkage<br>Clutch | Dynomometer or road test<br>Check noise with stethoscope<br>Check shift linkage | Wear safety glasses<br>Beware of moving parts<br><br>May get foreign material in eye<br>Clothing or long hair may catch in moving parts |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine from dyno or road test what the problems are<br>Using stethoscope determine what gear or bearings are at fault<br>Determine if shift linkage meets manual spec | Noise in transmission<br>Hard shifting | Road failure<br>Hard shifting |

# (TASK STATEMENT) N-1 DIAGNOSE TRANSMISSION PROBLEMS (STD)

## SCIENCE

Simple machines used to gain mechanical advantage  Gears
Work input, work output, friction and efficiency in simple machines  Applied force power output
Effects of friction on work processes and product quality  Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

## MATH -- NUMBER SYSTEMS

Set of Real numbers  Rationals
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers  Dyno

Basic Arithmetic Skills and Concepts
- Ration (gears)

Basic Measurement Skills and Concepts
- Instruments  Stethoscope
- Metric and English measure and conversion
- Measurement Geometric
  - Angle  Gear helix
- Measurement Non-geometric
  - Speed
- Reading and interpreting tables charts, and graphs
  - Logs  Transmission charts

Basic Logic
- Deductive

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Spec Chart | Comprehension<br>Progress report<br>Terminology |
| Writing | Test result, cost estimate | Penmanship<br>Spelling<br>Reports<br>Terminology |
| Listening | Noise level  pitch, knocking sound | Auditory discrimination |
| Viewing | Loose U joints | Visual analysis<br>Detail and inference<br>Recognition of symbols |
| Touching | Car vibration | Vibration |

# (TASK STATEMENT) N-2 SERVICE AND REPAIR TRANSMISSION PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S I K
Transmission stand
Clutch aligning tool
Puller set
Gear lube

Clutch
Transmission
Clutch release bearing
Linkage

## PERFORMANCE KNOWLEDGE

Remove, disassemble, clean and inspect
Adjust, repair or replace defective parts
Assemble, adjust, test and install

## SAFETY – HAZARD

Wear safety glasses
Weigh of transmission
Use of safety stands

May get foreign material in eye
Use transmission jack

Car may slip off jack and cause accident or damage to car

## DECISIONS

Determine from inspection what parts are defective
Determine from service manual how to adjust, repair and replace parts
Determine if repairs are complete : dyno or road test

## CUES

Clutch slipping
Noise in transmission

Hard shifting
Foreign material in gear case

## ERRORS

Road failure
Damage transmission or clutch and linkage parts

## ASK STATEMENT) N-2 SERVICE AND REPAIR TRANSMISSION PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage Gears
Work input, work output, friction and efficiency in simple machines Applied force power output
Effects of friction on work processes and product quality Power loss due to friction

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Work g together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of Real numbers Rationals
Fundamental Operations (Calculation)
Use of computing devices and mechanical aids
- Computers Dyno

Basic Arithmetic Skills and Concepts
- Ration (gears)

Basic Measurement Skills and Concepts
- Instruments Stethoscope
- Metric and English measure and conversion
- Measurement Geometric
  - Angle Gear helix
- Measurement Non-geometric
  - Speed
- Reading and interpreting tables, charts, and graphs
  - Logs Transmission charts

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments Clutch aligning tool
- Measurement Non-geometric
  - Liquid Pts gear lube

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Speaking | Customer complaint | Terminology<br>Logic |
| Reading | Spec. Chart | Comprehension<br>Progress report<br>Terminology |
| Writing | Test result, cost estimate | Penmanship<br>Spelling<br>Reports<br>Terminology |
| Listening | Noise level - pitch, knocking sound | Auditory discrimination |
| Viewing | Loose U joints | Visual analysis<br>Detail and inference<br>Recognition of symbols |
| Touching | Car vibration | Vibration |
| Smelling | Burned clutch | |

## DUTY O. REPAIRING TRANSMISSIONS (AUTOMATIC)

1. Diagnose transmission probelms (AUTO)
2. Service transmission components

(TASK STATEMENT) **O-1 DIAGNOSE TRANSMISSION PROBLEMS (AUTO)**

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON | PERFORMANCE KNOWLEDGE | SAFETY – HAZARD |
|---|---|---|
| Dynomometer<br>S T K<br>Oil pressure gauge<br><br>Automatic transmission<br>Torque convertor | Check automatic transmission fluid<br>Administer pressure, temperature and dynomometer tests | Wear safety glasses<br>Beware oil under pressure<br>Use care in use of Dyno<br><br>Foreign objects in eyes<br>Oil could burn body<br>Car under power and speed conditions |

| DECISIONS | CUES | ERRORS |
|---|---|---|
| Determine if fluid is full or contaminated<br>Determine if pressures are at specified levels<br>Determine if clutches or bands are malfunctioning | Brown or black (Discolored) fluid<br>Low oil pressures<br>Slipping shift points | Misquete problem and price<br>Road break down |

## ASK STATEMENT) O-1 DIAGNOSE TRANSMISSION PROBLEMS (AUTO)

### SCIENCE

Fluids under pressure — Hydraulic transfer of pressure
Simple machines used to gain mechanical advantage — Planetary gears
Centrifugal forces developed by bodies in rotation — Used in torque converter

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH – NUMBER SYSTEMS

Set of real numbers
- Integers — Hydraulic pressures

Uses of Numbers (without calculation)
- Counting — Band adjustment

Basic Measurement Skills and Concepts
- Measurement Non-geometric — Torque wrench
  - Pressure
  - Temperature

Basic Logic
- Deductive

### COMMUNICATIONS

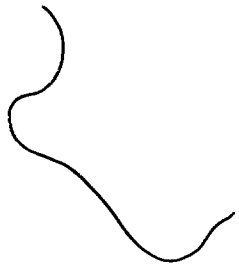
| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Spec chart, Oil contamination | Visual analysis<br>Detail and Inference<br>Color Discrimination<br>Recognition of symbols |
| Listening | Knock, slipping, scraping, buzzing - low oil | Noise discriminations |
| Writing | Analysis report, cost estimate | Penmanship<br>Spelling<br>Reports (Recommendation)<br>Terminology<br>Process Report Instruction |
| Reading | Shop manual--Spec chart | Comprehension<br>Terminology |
| Smelling | Burned oil--odor | Odor |

## (TASK STATEMENT) O-2 SERVICE TRANSMISSION COMPONENTS (AUTO)

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Special automatic transmission tools
Transmission clutch press

Automatic transmission torque converter



### PERFORMANCE KNOWLEDGE

R & R automatic transmission and torque converter
Disassemble, clean and inspect parts
Rebuild and reassemble transmission
Flush or replace converter

### SAFETY — HAZARD

Wear safety glasses
Flush cleaning solvents
Secure transmission on trans. jack
Support car on jack stands

### DECISIONS

Determine the need to repair or replace parts (Clutch, bands, seals, etc.)
Determine if the converter is reusable

### CUES

Worn parts
Plugged converter
Cracked parts

### ERRORS

Transmission will malfunction
Car will break down
May burn out transmission

## ASK STATEMENT) O-2 SERVICE TRANSMISSION COMPONENTS (AUTO)

### SCIENCE

Fluids under pressure  Hydraulic transfer of pressure
Simple machines used to gain mechanical advantage  Planetary gears
Centrifugal forces developed by bodies in rotation  Used in torque convertor

The following principles of behavioral patterns should be included

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Set of real numbers
- Integers  Hydraulic pressures

Uses of Numbers (without calculation)
- Counting  Band adjustment

Basic Measurement Skills and Concepts
- Measurement  Non-geometric  Torque wrench
  - Pressure
  - Temperature

Basic Logic
- Deductive

Basic measurement Skills and Concepts
- Measurement: Non-geometric
  - Liquid  Cleaning solution
  - Instrument  Dial Indicator
- Measurement  Geometric
  - Linear

Basic Arithmetic Skills and Concepts
- Ratio and proportion

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Spec. chart, Instruments | Visual Analysis<br>Detail inference<br>Color Discrimination |
| Reading | Wiring diagram, condition of wires | Comprehension<br>Description of mechanism<br>Terminology<br>Process report instruction |
| Writing | Report analysis, cost estimate | Penmanship<br>Spelling<br>Reports (recommendation)<br>Terminology<br>Clarity of expression |

## DUTY P. MAINTAINING AND REPAIRING ELECTRICAL SYSTEMS

1. Diagnose electrical systems problems
2. Service and repair electrical systems components

# (TASK STATEMENT) P-1 DIAGNOSE ELECTRICAL SYSTEM PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Volt-amp meter
Test light
Ohm meter

Generator
Regulator
Starter
Solonoid
Battery
Headlights
Taillights
Turn signals
Courtesy lights

## PERFORMANCE KNOWLEDGE

Test generating system per specifications
Test starting circuit
Test battery
Check lights for operation

## SAFETY – HAZARD

Wear safety glasses
Be careful of test equipment
Beware of hot wires or cables

Foreign material in eyes
Wires entangled in moving parts
Hot wires cause fires or burn hands

## DECISIONS

Determine if charging circuit is functioning according to specifications
Determine if the cranking circuit is operating correctly (Amp draw) (cranking RPM)
See if battery is at peak performance
See if all lights work

## CUES

Generator light on
Starter inoperative
Battery voltage low
Lights inoperative

## ERRORS

Car will not start
Lights will not work

## ASK STATEMENT) P-1 DIAGNOSE ELECTRICAL SYSTEM PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage  Pulleys on generator gears on starter
Magnetic fields of force -Basis for electricity
Transfer of energy from one form to another  Mechanical to electrical  Electrical to mechanical
Resistance of materials to flow of electrical current  Wire size resistors

The following principles of behavioral patterns should be included:

Professionalism
- Personality conflicts
- Communications
- Respect
  - for others
  - for tools and equipment, etc.
- Loyalty
  - To peers
    - Customers
    - Company
- Cooperative venture
  - Working together
  - Encouragement
  - Seek help of others (specialist)
  - Housekeeping

Dependability
- On time
- Regularity
- Accuracy of repair

Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Use of computing devices and mechanical aids
- Calculators  Electrical

Basic Measurement Skills and Concepts
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative erro
- significant digits, and tolerance -Calculators
- Instruments —Volt amp meter, continuity tester, Ohm meter, hydrometer
- Measurement: Non-geometric -Volt, amp, Ohm
- Reading and interpreting tables, charts, and graphs -Specification charts, wiring schematic

Use of Real numbers
- Rationals

Basic Logic
- Deductive

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Reading | Wiring diagram, condition of wires | Comprehension<br>Description of mechanism<br>Terminology<br>Process report instruction |
| Viewing | Spec, chart, Instruments | Visual analysis<br>Detail and inference<br>Recognition of symbols (Meters) |
| Writing | Report analysis, cost estimate | Penmanship<br>Spelling<br>Reports (Recommendations)<br>Terminology<br>Clarity of expression |

# (TASK STATEMENT) P-2 SERVICE AND REPAIR ELECTRICAL SYSTEM COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Volt-Amp meter
Ohm meter
Hydrometer
Generator-regulator testor
Bearing puller
Battery lift strap

Generator
Regulator
Starter
Solonoid
Battery
Lights

## PERFORMANCE KNOWLEDGE

Repair generator
Repair starter
Repair or replace solonoid
Charge or replace battery
Repair lights

## SAFETY – HAZARD

Wear safety glasses
Beware moving parts
Beware hot wires

Foreign material in eyes
Test or run leads entangled in moving parts
Hot wires cause fire or burns

## DECISIONS

Determine if the generator can be repaired per. specifications
Determine if starter can be repaired

## CUES

Parts cost may exceed price of rebuilt unit
Specification charts
Parts cost sheet

## ERRORS

Car may not start
May stop on highway
Battery may not hold charge

## TASK STATEMENT) P-2 SERVICE AND REPAIR ELECTRICAL SYSTEM COMPONENTS

### SCIENCE

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Magnetic fields of force  Basis for electricity
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- Measurement: Non-geometric—Volt, amp, Ohm
- Reading and interpreting tables, charts, and graphs – Specification charts, wiring schematic

Use of Real numbers
- Rationals

Basic Logic
- Deductive

Basic Measurement Skills and Concepts
- Instruments—Battery charger
- Rate – Rate of charge
- Measurement: Non-geometric
  - Time

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Wiring Diagram<br>Condition of wires | Visual analysis<br>Memory<br>Detail and inference<br>Recognition of symbols (include meters) |
| Writing | Report analysis<br>Cost estimate | Penmanship<br>Spelling<br>Reports (recommendation)<br>Termjnology<br>Clarity of expression |
| Viewing | Spec Chart, Instruments | Visual analysis<br>Detail and inference<br>Recognition of symbols (meters) |

## DUTY Q. SERVICING AND REPAIRING A/C UNIT

1. Diagnose a/c unit problems
2. Service and repair a/c components

# (TASK STATEMENT) Q-1 DIAGNOSE A/C UNIT PROBLEMS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Charging station
Volt-amp meter

Compresser
Clutch
Dehydrator-Receiver (driver)
Condensor
Evaporator
Thermostatic expansion valve (T.E V.)
Lines & fittings

## PERFORMANCE KNOWLEDGE

Run performance test
Check clutch operation
Check sight glass

## SAFETY – HAZARD

Wear safety glasses
Beware moving engine parts
Make sure test fittings are secure

Foreign material in eyes, especially freon
Test lines, clothing or hair may become entangled
May leak oil or freon

## DECISIONS

Determine performance results
See if outlet temperature is correct

## CUES

Outlet temperature low
Foam in sight glass
Clutch or belt slipping
Oil around lines, seals, or fittings

## ERRORS

No cooling
Wrong repairs made

## ASK STATEMENT) Q-1 DIAGNOSE A/C UNIT PROBLEMS

### SCIENCE

Simple machines used to gain mechanical advantage  Pulleys on generator gears on starter
Magnetic fields of force  Basis for electricity
Transfer of energy from one form to another  Mechanical to electrical  Electrical to mechanical
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The following principles of behavioral patterns should be included

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Dependability
- On time
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Image
- Personal appearance
- Conduct
- Trade

### MATH — NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Instruments  Charging station  Thickness gauge
- Reading and interpreting tables, charts, and graphs  Ambient temp chart
- Measurement  Non-geometric
  - Temperature
  - Pressure
- Measurement  Geometric
  - Linear

Set of real numbers
- Rationals

### COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Oil loss, sight glass, broken lines | Visual analysis<br>Memory<br>Detail and inference<br>Color discrimination<br>Recognition of symbols |
| Touching | Hot or cold | Temperature |
| Listening | Hiss of refrigerant leak | Noise discrimination |
| Reading | Spec. chart, ambient temperature | Comprehension<br>Terminology<br>Process report (instruction) |
| Writing | Analysis report, cost estimate | Clarity of expression<br>Terminology |

# (TASK STATEMENT) Q-2 SERVICE AND REPAIR A/C COMPONENTS

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

S.T.K.
Special clutch tools, Compressor tools
R-12 Charging station
Test goggles Leak tester

Clutch
Compressor
Condensor
Evaporator
Drier
T E V.
Lines

## PERFORMANCE KNOWLEDGE

Test and repair clutch
Test and repair or replace compressor
Check and/or repair condensor
Repair or replace evaporator
Replace drier
Check or replace T.E.V.

## SAFETY — HAZARD

Wear safety goggles
Beware moving parts

Freon
Hoses, test connections may catch in moving parts

## DECISIONS

Determine if more expedient to repair or replace
Determine if unit will now meet performance test

## CUES

Cost is more to repair than to replace
Sight glass clear
Outlet temperature correct

## ERRORS

A/C unit will not cool
Compressor tie up

# (TASK STATEMENT) Q-2 SERVICE AND REPAIR A/C COMPONENTS

## SCIENCE

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## MATH – NUMBER SYSTEMS

Basic Measurement Skills and Concepts
- Instruments  Charging station  Thickness gauge
- Reading and interpreting tables, charts, and graphs  Ambient temp. chart
- Measurement  Non-geometric
  - Temperature
  - Pressure
- Measurement  Geometric
  - Linear

Set of real numbers
- Rationals

Measurement  Non-geometric
- Torque

## COMMUNICATIONS

| PERFORMANCE MODES | EXAMPLES | SKILLS/CONCEPTS |
|---|---|---|
| Viewing | Oil loss, sight glass, broken lines | Visual analysis<br>Memory<br>Detail and inference<br>Color discrimination<br>Recognition of symbols |
| Touching | Hot or cold | Temperature |
| Listening | Hiss of refrigerant leak | Noise discrimination |
| Reading | Spec chart, ambient temperature | Comprehension<br>Terminology<br>Process ... (instruction) |
| Writing | Analysis report, cost estimate | Clarity expression<br>Terminology |

# ABBREVIATIONS

A/C—Air Condition
Auto-Automatic
Dyno—Dynomometer
Ign.—Ignitic
Lube—Lubrication
M.P.H.—Miles Per H
N.H.V.—Noise, Harsh oration
P/M—Preventive Maintenance
Pts.—Pints
Qt.—Quart
R.P.M.—Revolutions Per Minute
R & R—Remove and Replace
Specs.—Specification
S.T.K.—Standard Tool Kit
- ⅜" drive socket set
- ½" drive socket set
- Pliers 4
- Screw drivers 6 3stp-3 Philip's
- Hammer 16 oz.
- Carbon Scraper
- Punches 5
- Chisels 4
- Thickness gauge 2 flat and round
- End wrench ¼" to ⅞"
- Combination wrench ⅜" to ⅞"
- Tool Box

Std.—Standard
T.E.V.—Thermostatic Expansion Valve
√—check