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IDENTIFIERS *Industrial Mechanics

ABSTRACT The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the industrial mechanics occupation. A review of the contents will provide a guide for designing and organizing a curriculum for teaching skills and knowledge essential to an industrial mechanic. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in tabular form. Twenty-two 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 involve installation, repair, and maintenance of machinery and equipment used in the production, transportation, and storage of all types of industrial materials. The document concludes with an outline of an industrial mechanics responsibilities and frequency of some preventative maintenance procedures, and a list of personal tools needed by employees. (BP)
INDUSTRIAL MECHANIC
AN ANALYSIS OF THE INDUSTRIAL MECHANICS OCCUPATION

Developed By

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Occupational Analysis  
E.P.D.A. Sub Project 73402  
June 1, 1973 to December 30, 1974  
Director: Tom L. Hindes  
Coordinator: William L. Ashley

The Instructional Materials Laboratory  
Trade and Industrial Education  
The Ohio State University
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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 from 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 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 various 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.
The scope of the following analysis was designed to cover the work activities of installation, repair, and maintenance of various types of industrial equipment and machinery. The information reported for each task follows a generalized procedure for performing that type of work activity involved. A review of the contents will provide a guide for designing and organizing a curriculum for teaching the skills and knowledge essential to an industrial mechanic.
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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N.S. Gidwani, Chemistry
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Columbus, Ohio

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Columbus, Ohio

Jim VanArsdall, Mathematics
Worthington High School
Worthington, Ohio

Lillian Yontz, Biology
The Ohio State University
Caldwell, Ohio
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Marsha Opritza  Editorial Consultant
Rita Buccilla  Typist
Peg Bushelman  Typist
Carol Fausnaugh  Typist
Mindy Fausnaugh  Typist
Rita Hastings  Typist
Carol Hicks  Typist
Sue Holsinger  Typist
Barbara Hughes  Typist
Carol Marvin  Typist
Patti Nye  Typist
Kathy Roediger  Typist
Mary Salay  Typist
An Industrial Mechanic is a skilled worker involved in the installation, repair, and maintenance of machinery and equipment used in the production, transportation, and storage of all types of industrial materials. The industrial mechanic follows manufacturers’ specifications and instructions and performs to exact standards.
Duty A  Inspecting, Repairing, and Maintaining Chain Drive

1  Inspect chain drive
2  Repair chain drive
3  Maintain chain drive
<table>
<thead>
<tr>
<th>TASK STATEMENT</th>
<th>INSPECT CHAIN DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</strong></td>
<td><strong>PERFORMANCE KNOWLEDGE</strong></td>
</tr>
<tr>
<td>Flashlight</td>
<td>Remove inspection plate</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Operate hand crank</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Observe chain</td>
</tr>
<tr>
<td><strong>DECISIONS</strong></td>
<td><strong>CUES</strong></td>
</tr>
<tr>
<td>Determine repairs needed</td>
<td>Condition at chain drive</td>
</tr>
<tr>
<td></td>
<td>Unusual sounds</td>
</tr>
<tr>
<td>TASK STATEMENT</td>
<td>INSPECT CHAIN DRIVE</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
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</table>

<table>
<thead>
<tr>
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<td>Simple machines used to gain mechanical advantage (sprocket)</td>
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</tr>
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<td>Work input, work output, friction and efficiency in simple machines (work output) (Effects of lubrication)</td>
<td></td>
</tr>
<tr>
<td>Fluids under pressure (pressures, correct lubrication)</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Operating dimensions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
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<table>
<thead>
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<th>PERFORMANCE MODES</th>
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<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instruction to operator</td>
<td>Enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY - HAZARD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Ball peen hammer</td>
<td>Remove protective cover</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Crescent wrench</td>
<td>Remove broken chain</td>
<td>Observe pinch, tears</td>
</tr>
<tr>
<td>Ratchet wrench and sockets</td>
<td>Remove broken sprocket</td>
<td>All files to have handles</td>
</tr>
<tr>
<td>Flashlights</td>
<td>Weld tooth on sprocket</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/store or posted]</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Hand file to dress tooth</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Repair chain (repair links)</td>
<td></td>
</tr>
<tr>
<td>Wood blocking</td>
<td>Clean up foreign materials</td>
<td></td>
</tr>
<tr>
<td>Pliers</td>
<td>Install repaired sprocket</td>
<td></td>
</tr>
<tr>
<td>Box end wrenches</td>
<td>Loosen valve block</td>
<td></td>
</tr>
<tr>
<td>Files, flat, rat tail, bastard, 3 cornered</td>
<td>Install chain</td>
<td></td>
</tr>
<tr>
<td>New cotter keys</td>
<td>Adjust tension on chain</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>Align sprockets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tighten valve block</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Replace cover</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fill with proper oil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Run and check</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether repair or replace sprocket</td>
<td>Condition and life span of parts</td>
<td>Machine failure under load</td>
</tr>
<tr>
<td>Determine whether to repair broken chain</td>
<td>Foreign object present</td>
<td></td>
</tr>
</tbody>
</table>
### TASK STATEMENT: REPAIR CHAIN DRIVE

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [sprocket] Work input, work output, friction and efficiency in simple machines (work output) [Effects of lubrication] Fluids under pressure [oil pump fluids under pressure] Read and interpret charts, tables and/or graphs Inertia and momentum Motion resulting from two or more forces acting on a point in a body [motion from a fixed point] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials</td>
<td>Measures of length Measure with the Metric and English system and convert between them Operating Dimensions</td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Parts and repair manual</td>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Writing</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Requisition for parts</td>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
## Maintain Chain Drive

### Tools, Equipment, Materials, Objects Acted Upon
- Ratchet and sockets
- Socket head wrenches
- Hammer
- Wiping cloth

### Performance Knowledge
- Remove cover
- Align sprockets
- Adjust chain tension
- Clean oil sump
- Replace cover

### Safety - Hazard
- Safety glasses
- Pinch points
- Oil spills
- Slips and falls
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### Decisions
- Determine maintenance services to perform

### Cues
- Standard preventative maintenance schedule

### Errors
- Machine failure under load
### TASK STATEMENT

**MAINTAIN CHAIN DRIVE**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [sprocket] Work input, work output, friction and efficiency in simple machines (work output) [Effects of lubrication] Fluids under pressure [pressures, correct lubrication] Inertia and momentum</td>
<td>Operating dimensions</td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

#### PERFORMANCE MODES
- Reading
- Speaking
- Viewing

#### EXAMPLES
- Preventative maintenance
- Instructions to operator
- Equipment

#### SKILLS/CONCEPTS
- Comprehension, detail/inference, description of mechanism, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
Duty B  Inspecting, Repairing, and Maintaining Direct Drive

1. Inspect direct drive coupling
2. Repair direct drive coupling
3. Maintain direct drive coupling
(TASK STATEMENT) **INSPECT DIRECT DRIVE COUPLING**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Remove inspection plate</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Observe while running</td>
<td>Caution - moving parts</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Listen for unusual noise</td>
<td>Grease or oil spills</td>
</tr>
<tr>
<td>Socket wrenches</td>
<td>Feel vibration</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Screwdrivers</td>
<td>Try to achieve harmonics of coupling</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>(Adjust speed to remove)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stop machine, feel heat of couplings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Observe lubrication</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine repairs needed</td>
<td>Condition of equipment, vibration, heat</td>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
## ASK STATEMENT

**INSPECT DIRECT DRIVE COUPLING**

### SCIENCE
- Hookes Law
- Work input, work output, friction and efficiency in simple machines [Effects of lubrication]
- Resistance of materials to change in shape [twisting, bending]
- Harmonies (vibration noise factor)
- Relationship of force to distortion in an elastic body

### MATH - NUMBER SYSTEMS
- Operating dimensions

### COMMUNICATIONS

#### PERFORMANCE MODES
- Reading
- Speaking
- Viewing
- Listening
- Touching

#### EXAMPLES
- Inspection order
- Instructions of operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### SKILLS/CONCEPTS
- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
### Tools, Equipment, Materials, Objects Acted Upon
- Ratchet and sockets
- Socket head wrenches
- File
- Two dial indicators
- Aviation snips
- Shim stock (brass)
- Electric drill motor and drills
- Extension cord
- Reamer
- Flashlight
- Inspection mirror
- Straight edge
- Grease (if required)
- Grease gun
- Taper pins
- Electric drill motor and drills
- Extension cord
- Reamer
- Flashlight
- Inspection mirror
- Straight edge
- Grease (if required)
- Grease gun
- Taper pins

### Performance, Knowledge
- Lock out main switch
- Remove guard
- Remove motor mount bolts
- Loosen coupling set screws
- Slide motor back
- Remove coupling
- Deburr shafts
- Align motor shaft with gear box shaft
- Drill and ream two opposing corners for taper pins
- Move motor back
- Realign motor
- Install taper pins and mounting bolts
- Install coupling
- Lubricate as required
- Install guard
- Run and check

### Safety - Hazard
- Safety glasses
- File handle on all files
- Lock out main switch
- Smoking not permitted where flammable liquids and paint are being used or stored or where posted
- Report all injuries
- Check for pinch points
- Ear plugs to be worn in a high noise level area

### Decisions
Determine whether to repair or replace worn coupling

### Cues
Misalignment: lack of lubricant, condition and life span of parts

### Errors
Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Measure of length</td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body</td>
<td>Measure of time and speed</td>
</tr>
<tr>
<td>Resistance of materials to change in shape (twisting, and bending)</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Perfect elasticity (Hooke's Law)</td>
<td></td>
</tr>
<tr>
<td>Harmonies</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
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<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td>Comprehension, detail/inference, trade</td>
</tr>
<tr>
<td></td>
<td>Parts and repair manual</td>
<td>terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instruction to operator</td>
<td>Description of mechanism, definition,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>instructions</td>
</tr>
<tr>
<td>Writing</td>
<td>Requisition for parts</td>
<td>Trade terminology, enunciation, clarity</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td></td>
<td>Penmanship, spelling, classification,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>terminology</td>
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<td></td>
<td></td>
<td>Visual analysis, describing, logic,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>detail/inference</td>
</tr>
</tbody>
</table>
### Task Statement

**Maintain Direct Drive Coupling**

### Tools, Equipment, Materials, Objects Acted Upon
- Socket head wrenches
- Ratchet and sockets
- Screwdrivers
- Flash light
- Grease gun
- Grease

### Performance Knowledge
- Lock out main switch
- Remove guard
- Tighten motor mount screws and gear box screws
- Tighten coupling set screws
- Tighten coupling cover screws
- Lubricate coupling
- Install guard
- Run and check

### Safety - Hazard
- Safety glasses
- Lock out main switch
- Watch for pinch points
- Oil, grease or debris on floor
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### Decisions
- Determine maintenance services to perform

### Cues
- Standard preventative maintenance schedule

### Errors
- Machine failure under load
### Task Statement
Maintain direct drive coupling

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Hookes Law  
Relationship of force to distortion in an elastic body  
Resistance of materials to change in shape [twisting and bending]  
Harmonies  
Effects of lubrication | Measure of speed and time [speed and RPM]  
Operating dimensions |

### Communications

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty C Inspecting, Repairing, and Maintaining Flat Belt

1. Inspect flat belt drive
2. Repair flat belt drive
3. Maintain flat belt drive
<table>
<thead>
<tr>
<th>TASK STATEMENT</th>
<th>INSPECT FLAT BELT DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</strong></td>
<td><strong>PERFORMANCE KNOWLEDGE</strong></td>
</tr>
</tbody>
</table>
| Flashlight | Check lagging on head pulley  
Check belt tension  
Check wear on belt  
Check alignment  
Check mounting bolts  
Check idler bearings  
Check for vibration  
Check grease in motor bearing  
Check shaft bearing  
Check driven shaft for whip  
Check take-up adjustment | Safety glasses  
Grease on floor  
Debris on floor  
[Smoking not permitted where flammable liquids and paint are being used/stored or posted]  
[Report all injuries] |

<table>
<thead>
<tr>
<th><strong>DECISIONS</strong></th>
<th><strong>CUES</strong></th>
<th><strong>ERRORS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine repairs needed</td>
<td>Condition of equipment, vibration, tension, alignment</td>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
### ASK STATEMENT: INSPECT FLAT BELT DRIVE

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [belts and pulleys]</td>
<td>Measures of length, width, thickness</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td></td>
</tr>
<tr>
<td>Composition of matter, including protons, neutrons, electrons, atoms,</td>
<td></td>
</tr>
<tr>
<td>molecules, elements [composition of matter]</td>
<td></td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body [elastic body]</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape [stretching]</td>
<td></td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Belt clamps</td>
<td>Release tension on idler roll</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Come-a-long</td>
<td>Remove lacing pin from belt</td>
<td>No finger rings or watches</td>
</tr>
<tr>
<td>Square</td>
<td>Fasten belt clamps to belt</td>
<td>To protect one's self from moving equipment, rope off or barricade area around machine</td>
</tr>
<tr>
<td>Belt knife</td>
<td>Ingage come-a-long to overlap belt</td>
<td>Observe pinch points</td>
</tr>
<tr>
<td>Hammer</td>
<td>Mark belt to desired length</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Lacing</td>
<td>Square both ends</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Crescent wrenches</td>
<td>Cut belts to remove excess</td>
<td></td>
</tr>
<tr>
<td>Side cuts</td>
<td>Install new lacing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operate come-a-long to install pin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Release come-a-long</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remove belt clamps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust take up idler</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Run and check belt</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine if belt is slipping

**CUES**
- Tension

**ERRORS**
- Stretched belt
**SCIENCE**

- Simple machines used to gain mechanical advantage (pulleys and belts)
- Work input, work output, friction and efficiency in simple machines (friction)
- Effect of heating and cooling on expansion of materials (change of dimension)
- Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements (composition of matter)
- Relationship of force to distortion in an elastic body
- Resistance of materials to change in shape (stretching)

**MATH - NUMBER SYSTEMS**

- Measures of length, width and thickness
- Operating dimensions

## COMMUNICATIONS

### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
</tr>
<tr>
<td>Parts and repair manual</td>
<td></td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Writing</td>
<td>Requisition for parts</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
</tr>
</tbody>
</table>

### SKILLS/CONCEPTS

<table>
<thead>
<tr>
<th>Skills/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
**TASK STATEMENT** MAINTAIN FLAT BELT DRIVE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease</td>
<td>Replace belt lacing pin</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Grease gun</td>
<td>Adjust take-up</td>
<td>Observe pinch points</td>
</tr>
<tr>
<td>Crescent wrench</td>
<td>Adjust alignment</td>
<td>Apply crescent wrench in proper manner</td>
</tr>
<tr>
<td>Lacing pin</td>
<td>Lubricate idler</td>
<td>to prevent jaws from spreading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Report all injuries]</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine maintenance services to perform

**CUES**

Standard preventative maintenance schedule

**ERRORS**

Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Resistance of materials to change in shape  
Accommodation of materials to change in shape | Measures of length, width, and thickness  
Operating dimensions |

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
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<tbody>
<tr>
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<tr>
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<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty D  Inspecting, Repairing, and Maintaining Gear Drive

1  Inspect open gear drive
2  Repair open gear drive
3  Maintain open gear drive
## (TASK STATEMENT) INSPECT OPEN GEAR DRIVE

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Work platform
- Ratchet wrench and socket
- Ball peen hammer
- Flashlight
- Socket head wrenches

### PERFORMANCE KNOWLEDGE
- Install work platform
- Remove guard
- Run continuously
- Listen for knocks
- Observe bull gear for wobble
- Observe pinion shaft for whip
- Check bearings for heat
- Observe pinion gear wobble
- Inspect taper keys for looseness
- Hammer blows for cracked gear
- Hammer blows for cracked shaft
- Verify correct grease

### SAFETY – HAZARD
- Safety glasses
- Pinch points
- No "make shift" defective
- Scaffolds, rigging or staging
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### DECISIONS
- Determine repairs needed

### CUES
- Condition of gear drive: sound

### ERRORS
- Machine failure under load
**ASK STATEMENT**) **INSPECT OPEN GEAR DRIVE**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Arrangement of molecules, atoms, ions, and the effect on structure and strength of materials  
Effect of heating and cooling on state of matter  
Effects of lubrication | Measure length, width and thickness  
Operating dimensions |

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
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<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, torsion</td>
</tr>
</tbody>
</table>
### Tools, Equipment, Materials, Objects Acted Upon
- Ratchet wrenches and sockets
- Socket head wrenches
- Ball peen hammer (medium)
- Brass rod
- Flashlight
- File
- Emory cloth
- Gear puller
- Center punch
- Open gear lubricant
- Putty knife
- Work platform
- Feeler gauges

### Performance Knowledge
- Properties of open gear lubricant
- Place work platform
- Remove guard
- Remove key
- Remove pinion gear
- Inspect shaft damage
- Deburr shaft
- Acquire new key
- Install pinion gear on shaft, adjust clearance
- Align keyways
- Match “witness” marks
- Install new wedge key
- Lubricate gears
- Replace guard
- Unlock switch-check operation

### Safety - Hazard
- Safety glasses
- Secure main switch (lock out)
- No horse play
- Watch for fork trucks
- Check for pinch points
- Handle for file

- Smoking not permitted where flammable liquids and paint are being used/stored or posted
- Report all injuries

### Decisions
- Determine if key is sheared

### Cues
- Condition and life span of parts

### Errors
- Machine failure under load
**TASK STATEMENT**

**REPAIR OPEN GEAR DRIVE**

<table>
<thead>
<tr>
<th><strong>SCIENCE</strong></th>
<th><strong>MATH - NUMBER SYSTEMS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inertia and momentum</td>
<td>Torque (inch-pounds) = force pounds x radius (inches)</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines [friction]</td>
<td>Simple machines used to gain mechanical advantage [gears]</td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Arrangement of molecules, atoms, ions and the effect on structure and strength of materials</td>
<td></td>
</tr>
<tr>
<td>Hook’s Law, Electrolysis</td>
<td></td>
</tr>
<tr>
<td>Shear modulus or the coefficient of rigidity is the ratio of the stress to strain for the case of a shear or a twist; it the shearing stress divided by the fractional shear</td>
<td></td>
</tr>
<tr>
<td>Effects of heating and cooling on state of matter [gaskets]</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape [to torque]</td>
<td></td>
</tr>
<tr>
<td>Effects of eccentric loading; of wear on gear</td>
<td></td>
</tr>
<tr>
<td>Transfer of heat from one body to another [heat on materials]</td>
<td></td>
</tr>
<tr>
<td>Effect of lubrication; of severe vibration on materials</td>
<td></td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th><strong>PERFORMANCE MODES</strong></th>
<th><strong>EXAMPLES</strong></th>
<th><strong>SKILLS/CONCEPTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td></td>
<td>Parts and repair manual</td>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Writing</td>
<td>Requisition for parts</td>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
### Task Statement

**Maintain Open Gear Drive**

### Tools, Equipment, Materials, Objects Acted Upon

- Ratchet and socket
- Ball peen hammer
- File
- Work platform
- Flashlight
- Open gear lubricant
- Putty knife

### Performance Knowledge

- Place work platform
- Remove guard
- Clean pinion and bull gear
- Adjust clearance between teeth
- Deburr teeth pinion and bull gear
- Set wedge keys firmly
- Lubricate
- Replace guard

### Safety - Hazard

- Safety glasses
- Pinch points
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### Decisions

- Determine maintenance services to perform

### Cues

- Standard preventative maintenance schedule

### Errors

- Machine failure under load
## Skill Statement
MAINTAIN OPEN GEAR DRIVE

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td>Measure of length, width and thickness</td>
</tr>
<tr>
<td>Torque</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Effects of lubrication</td>
<td></td>
</tr>
</tbody>
</table>

### Communications

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
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<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
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<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty E  Inspecting, Repairing, and Maintaining Gear Box Drive

1. Inspect gear box drive
2. Repair gear box drive
3. Maintain gear box drive
### Task Statement

**Inspect Gear Box Drive**

### Tools, Equipment, Materials, Objects Acted Upon

- Flashlight
- Wiping cloth
- Socket head cap screw wrenches
- Eye bolt
- Nylon sling
- Chain hoist
- Ladder
- Tag line

### Performance Knowledge

- Listen to gear box run
- Feel for heat
- Smell for unusual odor
- Vibration factor
- Check oil level leaks
- Shut off
- Secure safety switch
- Check mounting screws, external
- Remove cover plate and secure
- Inspect gears (visual)
- Inspect bearings feel end play
- Inspect shafting
- Inspect breather (clean)
- Inspect oil residue, sludge
- Inspect oil seals and gaskets
- Replace cover

### Decisions

- Determine repairs needed

### Cues

- Unusual noises, temperature, odor, vibrations

### Errors

- Machine failure under load

### Safety - Hazard

- Safety glasses
- Oil spills
- Falls from ladder
- Smoking could cause fire
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]
### Task Statement

**Inspect Gear Box Drive**

### SCIENCE

- Effect of heating and cooling on state of matter (gaskets)
- Simple machines used to gain mechanical advantage
- Work input, work output, friction and efficiency in simple machines
- Resistance to torque
- Effect of wear on gears
- Transfer of heat from one body to another
- Effect of severe vibration on materials
- Effect of eccentric loading
- Effect of heat on materials
- Relationship of force to distortion in an elastic body
- Arrangement of molecules, atoms and ions and the effect on structure and strength of matter
- Resistance of materials to change in shape
- Effects of lubrication

### MATH - NUMBER SYSTEMS

- Liquid and dry measures (liquid measures)
- Operating dimensions

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Speaking**
- **Viewing**
- **Listening**
- **Touching**

#### EXAMPLES

- Inspection order
- Instructions to operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### SKILLS/CONCEPTS

- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, torsion
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socket head wrenches</td>
<td>Remove cover plates</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Persuader (3/4-inch pipe, 12-inch long)</td>
<td>Drain oil</td>
<td>Oil on floor</td>
</tr>
<tr>
<td>Drain pan</td>
<td>Inspect gears and bearings</td>
<td>Operator shut off machine and secure</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Remove broken parts (teeth)</td>
<td>Never pour flammable liquids in sewers or drains</td>
</tr>
<tr>
<td>Work bench</td>
<td>Remove shaft with broken gear</td>
<td>Use caution when working on machines that are jammed</td>
</tr>
<tr>
<td>Ball peen hammer</td>
<td>Flush and clean box</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Brass rod</td>
<td>Wipe dry</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>File</td>
<td>Replace gear and mating gear</td>
<td></td>
</tr>
<tr>
<td>Flashlight</td>
<td>Wipe dry</td>
<td></td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td>Replace gear and mating gear in box</td>
<td></td>
</tr>
<tr>
<td>Lubricants</td>
<td>Reinstall gear train and bearings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reinstall retainer caps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reinstall cover plate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fill with proper oil to designated level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Run and check for operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Know properties and addition of oil</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine if the trains locked</td>
<td>Defective gear</td>
<td>Machine failure under load</td>
</tr>
<tr>
<td>Determine whether to repair or replace parts</td>
<td>Condition and life span of parts</td>
<td></td>
</tr>
</tbody>
</table>

Determine-if the trains locked
Determine whether to repair or replace parts
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricants</td>
<td>Liquid measure</td>
</tr>
<tr>
<td>Arrangement of molecules, atoms and ions and the effect on</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>structure and strength of materials</td>
<td></td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple</td>
<td></td>
</tr>
<tr>
<td>machines</td>
<td></td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td></td>
</tr>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE MODES</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Speaking</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
</tbody>
</table>
### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Flashlight
- Wiping cloth
- Socket head wrenches
- Small screwdriver
- Large screwdriver
- Lubricants

### PERFORMANCE KNOWLEDGE
- Check oil level
- Check for leaks
- Check for hot bearings
- Check for odor of hot oil
- Check for loose cap screws
- Listen for noise
- Feel for vibration
- Properties of lubricant

### SAFETY – HAZARD
- Safety glasses
- Whenever more than one employee is working on the same equipment, each employee should attach safety lock to the switch, and remove it only when job is completed.
- No spitting on floor or equipment
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### DECISIONS
- Determine maintenance services to perform

### CUES
- Standard preventative maintenance schedule

### ERRORS
- Machine failure under load
### Task Statement

**Maintain Gear Box Drive**

### Science

| Simple machines used to gain mechanical advantage |
| Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements |
| Arrangement of molecules, atoms and ions and the effect on structure and strength of materials |
| Amount of oil too much/too little |
| Oil grooves |
| Effects of lubricants |

### Math - Number Systems

| Liquid and dry measures |
| Operating dimensions |

### Communications

#### Performance Modes

- **Reading**
- **Speaking**
- **Viewing**

#### Examples

- Preventative maintenance schedule
- Instructions to operator
- Equipment

#### Skills/Concepts

- Comprehension, detail/inference, description of mechanism, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
Duty F  Inspecting, Repairing, and Maintaining Rack and Pinion Drive

1  Inspect rack and pinion drive
2  Repair rack and pinion drive
3  Maintain rack and pinion drive
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Wipe and clean rack and pinion</td>
<td>Oil spills</td>
</tr>
<tr>
<td>Lubricants</td>
<td>Inspect for burrs</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td>Inspect for bent or broken teeth</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>Hand operate for smooth operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relubricate gears</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine repairs needed</td>
<td>Burrs</td>
<td>Machine failure under load</td>
</tr>
<tr>
<td></td>
<td>Condition and life span of parts</td>
<td></td>
</tr>
</tbody>
</table>
### TASK STATEMENT

**INSPECT RACK AND PINION DRIVE**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage (gears)  
Work input, work output, friction and efficiency in simple machines  
Inertia and momentum  
Arrangement of molecules, atoms and ions and the effect on structure and strength of materials  
Resistance of materials to change in shape  
Effects of lubricants | Measures of length, width and thickness  
Operating dimensions |

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, torsion</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Ratchet wrench and sockets</td>
<td>Remove hand crank</td>
<td>Pinch points</td>
</tr>
<tr>
<td>Hammer</td>
<td>Remove shaft bearing assembly</td>
<td>Handle for file</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Install new pinion on shaft</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Gear puller</td>
<td>Reinstall, assembly in saddle</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>File</td>
<td>Reinstall hand crank</td>
<td></td>
</tr>
<tr>
<td>Lubricants</td>
<td>Operate hand crank for smooth operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lubricants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether to repair or replace pinion gear and rack</td>
<td>Condition and life span of parts</td>
<td>Carriage lock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unreleased, machine failure under load</td>
</tr>
<tr>
<td>SCIENCE</td>
<td>MATH – NUMBER SYSTEMS</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Simple machines used to gain mechanical advantage [gears]</td>
<td>Measure of length [pinion dimensions]</td>
<td></td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Wrench dimensions</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum [body at rest, body in motion]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [strength of material]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effects of lubrication</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Parts and repair manual</td>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Writing</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Requisition for parts</td>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY - HAZARD</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Brush</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td>Clean rack and pinion with small brush and solvent</td>
<td>File handle on file</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Wipe dry</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Deburr rack and pinion</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>File</td>
<td>Wipe clean</td>
<td></td>
</tr>
<tr>
<td>Lubricants</td>
<td>Lubricate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check for smooth operation</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine maintenance services to perform

**CUES**

Standard preventative maintenance schedule

**ERRORS**

Machine failure under load
### SCIENCE

Simple machines used to gain mechanical advantage (gears)
Work input, work output, friction and efficiency in simple machines
Inertia and momentum
Arrangement of molecules, atoms and ions and the effect on structure and strength of materials
Resistance of materials to change in shape
Effects of lubricants

### MATH - NUMBER SYSTEMS

Wrench dimensions
Operating dimensions

---

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
</tr>
</tbody>
</table>

#### EXAMPLES

- Preventative maintenance schedule
- Instructions to operator
- Equipment

#### SKILLS/CONCEPTS

- Comprehension, detail/inference, description of mechanism, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
Duty G  Inspecting, Repairing, and Maintaining Ring and Pinion Drive

1. Inspect ring and pinion drive of vertical lathe
2. Repair ring and pinion drive of vertical lathe
3. Maintain ring and pinion drive of vertical lathe
**TASK STATEMENT**

**INSPECT RING AND PINION DRIVE OF VERTICAL LATHE**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Raise rail to extreme position</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Remove inspection plate in chuck</td>
<td>Caution - moving machinery</td>
</tr>
<tr>
<td>Feeler gauges</td>
<td>Check retaining nut</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td>Reinstall plate</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>Check ring and pinion for burrs, broken</td>
<td></td>
</tr>
<tr>
<td></td>
<td>teeth, wear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Listen to operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feel for vibration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check lubrication</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine repairs needed

**CUES**

Burrs, broken teeth; unusual sounds and vibrations; condition and lifespan of parts

**ERRORS**

Machine failure under load
### TASK STATEMENT
Inspect ring and pinion drive of vertical lathe

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (gears)</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Operating clearances</td>
</tr>
<tr>
<td>Fluids under pressure - lubricants</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
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</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ratchet wrench and socket extension</td>
<td>Raise rail, move heads to extreme position</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Lock out main switch</td>
<td>Pinch points</td>
</tr>
<tr>
<td>Torque wrench</td>
<td>Remove inspection place in chuck</td>
<td>Smoking not permitted where flammable liquids and paint are being used/stored or posted</td>
</tr>
<tr>
<td>Feeler gauge</td>
<td>Remove retaining nut</td>
<td>Report all injuries</td>
</tr>
<tr>
<td>Wiping rags</td>
<td>Install three pick-up clamps on chuck</td>
<td></td>
</tr>
<tr>
<td>Flashlight</td>
<td>Lift off chuck</td>
<td></td>
</tr>
<tr>
<td>Oil can, oil</td>
<td>Lay chuck on block - inverted</td>
<td></td>
</tr>
<tr>
<td>Pick-up clamps</td>
<td>Remove pinion gear and gear box</td>
<td></td>
</tr>
<tr>
<td>Eye bolt</td>
<td>Remove broken ring gear on chuck</td>
<td></td>
</tr>
<tr>
<td>Three-legged chocker</td>
<td>Install new ring gear on chuck</td>
<td></td>
</tr>
<tr>
<td>Fork truck or overhead crane</td>
<td>Remove pinion gear and shaft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install new pinion gear, shaft, and bearings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reinstall pinion gear, gear box, and chuck</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tighten retaining nut (torque)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust pinion gear to ring gear, use feeler gauge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lubricate, run and check</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Replace inspection plate in chuck</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine whether to repair or replace parts

**CUES**

Condition and life span of parts

**ERRORS**

Machine failure under load
### Science

- Simple machines used to gain mechanical advantage (gears)
- Work input, work output, friction and efficiency in simple machines
- Fluids under pressure
- Transfer of energy from one form to another
- Inertia and momentum
- Torque
- Effects of lubricants

### Math - Number Systems

- Operating dimensions

### Communications

#### Performance Modes

- Reading
- Speaking
- Writing
- Viewing

#### Examples

- Repair service order
- Instructions to operator
- Requisition for parts
- Equipment

#### Skills/Concepts

- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
### Task Statement

**Maintain Ring and Pinion Drive of Vertical Lathe**

### Tools, Equipment, Materials, Objects Acted Upon
- Flashlight
- Feeler gauge
- Ratchet wrench, sockets and extension
- Wiping cloth

### Performance Knowledge
- Raise rail to extreme height
- Lock out main switch
- Remove inspection plate
- Adjust retaining nut if required
- Reinstall plate
- Check and adjust gear tooth clearance
- Deburr teeth - gear and pinion
- Lubricate as required
- Run and check

### Safety - Hazard
- Safety glasses
- Pinch points
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### Decisions
- Determine maintenance services to perform

### Cues
- Standard preventative maintenance schedule

### Errors
- Machine failure under load
### Task Statement

Maintain ring and pinion drive of vertical lathe.

### Science

- Simple machines used to gain mechanical advantage (gears)
- Work input, work output, friction and efficiency in simple machines
- Fluids under pressure (lubricants)
- Transfer of energy from one form to another
- Inertia and momentum
- Effects of lubricants

### Math - Number Systems

- Basic math skills
- Peeler gauge
- Operating dimensions

### Communications

- Preventative maintenance schedule
- Instructions to operator
- Equipment

<table>
<thead>
<tr>
<th>Skill/Concepts</th>
<th>Examples</th>
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<tr>
<td>General knowledge</td>
<td>Preventative maintenance schedule</td>
</tr>
<tr>
<td>Reading</td>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Speaking</td>
<td>Equipment</td>
</tr>
<tr>
<td>Viewing</td>
<td></td>
</tr>
</tbody>
</table>

**Skills/Concepts**
- Comprehension, detail/inference, description of mechanism, trade terminology, enunciation, clarity of expression, logic, visual analysis, describing, logic, detail/inference.
Duty H  Inspecting, Repairing, and Maintaining Variable Speed Drive

1. Inspect variable speed drive
2. Repair variable speed drive
3. Maintain variable speed drive
### TASK STATEMENT

**INSPECT VARIABLE SPEED DRIVE**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
</table>
| Ratchet and sockets  
Flashlight  
Wiping cloth | Remove inspection plate  
Observe belt  
Listen for belt slap  
Hand feel for vibration on motor  
Inspect all mounting bolts  
Inspect variable pulleys | Safety glasses  
Lock out main switch  
Do not talk to any operator while operating a machine  
Ordinary prescription glasses do not protect the eyes  
Wear safety caps if employee has long hair  
[Smoking not permitted where flammable liquids and paint are being used/stored or posted]  
[Report all injuries] |

### DECISIONS

- Determine repairs needed

### CUES

- Unusual sounds or vibrations; condition of equipment

### ERRORS

- Machine failure under load
### Science
- Simple machines used to gain mechanical advantage (pulleys)
- Work input, work output, friction and efficiency in simple machines
- Inertia and momentum (inertia)
- Relationship of force to distortion in an elastic body (distortion)
- Resistance of materials to change in shape (stretching)
- Effects of lubricants

### Math - Number Systems
- Measure of time and speed (speed-RPM)
  - \[ FPM = \text{Diameter} \times \text{RPM} \times 0.262 \]
- Operating dimensions

### Communications
#### Performance Modes
- Reading
- Speaking
- Viewing
- Listening
- Touching

#### Examples
- Inspection on order
- Instructions to operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### Skills/Concepts
- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratchet wrench and sockets</td>
</tr>
<tr>
<td>Socket head wrenches</td>
</tr>
<tr>
<td>Snap ring wrench</td>
</tr>
<tr>
<td>Flashlight</td>
</tr>
<tr>
<td>Hammer</td>
</tr>
<tr>
<td>Feet per minute meter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE-KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock out master switch</td>
</tr>
<tr>
<td>Remove guard and conveyor belt from variable drive</td>
</tr>
<tr>
<td>Retract motor to relax spring in drive pulley; loosen motor from base</td>
</tr>
<tr>
<td>Remove belt from driver and driven pulley, spring loaded pulley from shaft, snap ring from sheave, and spiral spring cartridge and nylon key</td>
</tr>
<tr>
<td>Install new spiral spring cartridge and key; lube shaft</td>
</tr>
<tr>
<td>Install snap ring to shaft and new belt</td>
</tr>
<tr>
<td>Align motor and bolt down</td>
</tr>
<tr>
<td>Rotate by hand to equalize belt</td>
</tr>
<tr>
<td>Start motor for operational check</td>
</tr>
<tr>
<td>Install conveyor belt</td>
</tr>
<tr>
<td>Run conveyor-operational check</td>
</tr>
<tr>
<td>Adjust pulley pitch to required feet per minute</td>
</tr>
<tr>
<td>Reinstall guard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether to repair or replace broken spring</td>
</tr>
<tr>
<td>Determine whether to repair or replace damaged belt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition and life span of parts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses</td>
</tr>
<tr>
<td>Never climb or walk over conveyors</td>
</tr>
<tr>
<td>Never use defective hammers, punches or wrenches</td>
</tr>
<tr>
<td>Never strike together material of equal hardness</td>
</tr>
<tr>
<td>Smoking not permitted where flammables and paint are being used/stored or posted</td>
</tr>
<tr>
<td>Report all injuries</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
## Task Statement

**Repair Variable Speed Drive**

### Science
- Simple machines used to gain mechanical advantage (pulleys)
- Work input, work output, friction, and efficiency in simple machines
- Inertia and momentum
- Relationship of force to distortion in an elastic body
- Resistance of materials to change in shape (stretching)
- Hooke's Law
- Effects of lubricants

### Math – Number Systems
- Measure of time and speed (RPM)
  \[ \text{RPM} = \text{Diameter (inches)} \times \text{RPM} \times 0.262 \]
- Operating dimensions

### Communications

#### Performance Modes
- **Reading**
  - Repair service order
  - Parts and repair manual
- **Speaking**
  - Instructions to operator
- **Writing**
  - Requisition for parts
- **Viewing**
  - Equipment

#### Examples
- Repair service order
- Parts and repair manual
- Instructions to operator
- Requisition for parts
- Equipment

#### Skills/Concepts
- Comprehension, detail/inference, trade terminology
- Description of mechanism, definition, instructions
- Trade terminology, enunciation, clarity of expression, logic
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
**MAINTAIN VARIABLE SPEED DRIVE**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease gun</td>
<td>Grease all fittings</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Operate fast and slow for proper operation</td>
<td>Lock out main switch</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Snug up all mounting bolts</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine maintenance services to perform

**CUES**
Standard preventative maintenance schedule

**ERRORS**
Machine failure under load
## Science

- Simple machines used to gain mechanical advantage [pulleys]
- Work input, work output, friction and efficiency in simple machines
- Inertia and momentum [inertia]
- Relationship of force to distortion in an elastic body [distortion]
- Resistance of materials to change in shape [stretching]
- Effects of lubricants

## Math - Number Systems

- Measure of time and speed [speed - RPM]
- \( FPM = \text{Diameter} \times \text{RPM} \times 0.262 \)
- Operating dimensions

## Communications

### Performance Modes

- **Reading**
- **Speaking**
- **Viewing**

### Examples

- Preventative maintenance schedule
- Instructions to operator
- Equipment

### Skills/Concepts

- Comprehension, detail/inference, description of mechanism, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
Duty I  Inspecting, Repairing, and Maintaining Vee Belt Drive

1. Inspect vee belt drive
2. Repair vee belt drive
3. Maintain vee belt drive
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belt tension meter Straight edge</td>
<td>Open door Check sheaves alignment and wear Check belt tension Check for cleanliness Inspect belts for wear Check for vibration Check mounting bolts</td>
<td>Safety glasses [Smoking not permitted where flammable liquids and paint are being used/stored or posted] [Report all injuries]</td>
</tr>
</tbody>
</table>

DECISIONS
Determine belt condition Determine if area needs cleaning

CUES
Condition of equipment; tension, vibration Noise

ERRORS
Machine failure under load
**ASK STATEMENT**: INSPECT VEE BELT DRIVE

### SCIENCE
- Simple machines used to gain mechanical advantage [pulleys]
- Work input, work output friction and efficiency in simple machines [friction]
- Effect of heating and cooling on expansion of materials
- Inertia and momentum
- Effect of friction on work processes and product quality [friction]
- Relationship of force to distortion in an elastic body
- Resistance of materials to change in shape
- Effects of lubricants

### MATH – NUMBER SYSTEMS
- Relation of force to distortion in an elastic body [belt deflection under pressure]
- Operating dimensions

### COMMUNICATIONS
#### PERFORMANCE MODES
- Reading
- Speaking
- Viewing
- Listening
- Touching

#### EXAMPLES
- Inspection order
- Instructions to operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### SKILLS/CONCEPTS
- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
### PERFORMANCE KNOWLEDGE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set of new matched belts</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Adjustable wrench (crescent)</td>
<td>Debris on floor</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Oil on floor</td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td>Never roll or pry belts on sheave</td>
</tr>
<tr>
<td>Wiping cloths</td>
<td>(pinch point)</td>
</tr>
<tr>
<td>Knife</td>
<td>Clean up all rags and material from floor upon completing assignment</td>
</tr>
<tr>
<td>Wire brush</td>
<td>While working overhead, never carry tools in pockets</td>
</tr>
<tr>
<td>Debris pan</td>
<td>Never use kerosene to clean parts or assemblies</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Auxiliary start button lock out</td>
</tr>
<tr>
<td>Belt tension meter</td>
<td>Wrenches must never be used as hammer</td>
</tr>
<tr>
<td>Sheave groove and belt guage</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Select-o-matic V-belt measuring device</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Hammer</td>
<td></td>
</tr>
</tbody>
</table>

- Open inspection door
- Release belt tension
- Remove old belts
- Determine length, size, quantity of belts and obtain clean sheaves
- Inspect sheaves
- Bell ring sheaves
- Check sheave retaining screws
- Check alignment of sheaves and adjust
- Install new belts
- Adjust tension
- Close door
- Run and check

### DECISIONS

Determine when to replace worn belts

### ERRORS

Machine failure under load

### CUES

- Misalignment, grit and dirt, normal wear
- Cracked sheaves (pulleys) do not ring
### SCIENCE

<table>
<thead>
<tr>
<th>Measures of length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matching length</td>
</tr>
<tr>
<td>Matching belts</td>
</tr>
<tr>
<td>Matching width</td>
</tr>
</tbody>
</table>

Effects of heating and cooling on expansion of materials
Inertia and momentum
Effects of friction on work processes and product quality
Relationship of force to distortion in an elastic body
Resistance of materials to change in shape

### MATH - NUMBER SYSTEMS

<table>
<thead>
<tr>
<th>Operating dimensions</th>
</tr>
</thead>
</table>

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
</tbody>
</table>

#### EXAMPLES

<table>
<thead>
<tr>
<th>Repair service order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts and repair manual</td>
</tr>
<tr>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Requisition for parts</td>
</tr>
<tr>
<td>Equipment</td>
</tr>
</tbody>
</table>

#### SKILLS/CONCEPTS

| Comprehension, detail/inference, trade terminology |
| Description of mechanism, definition, instructions |
| Trade terminology, enunciation, clarity of expression, logic |
| Penmanship, spelling, classification, terminology |
| Visual analysis, describing, logic, detail/inference |

---

ASK STATEMENT) REPAIR VEE BELT DRIVE
**TASK STATEMENT**

**MAINTAIN VEE BELT DRIVE**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoddard solvent</td>
</tr>
<tr>
<td>Wiping cloth</td>
</tr>
<tr>
<td>Flashlight</td>
</tr>
<tr>
<td>Adjustable wrench</td>
</tr>
<tr>
<td>Straight edge</td>
</tr>
<tr>
<td>Hammer</td>
</tr>
<tr>
<td>Socket head wrenches (Allen)</td>
</tr>
<tr>
<td>Belt tension meter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open inspection door</td>
</tr>
<tr>
<td>Clean belts (solvent)</td>
</tr>
<tr>
<td>Clean sheaves and area</td>
</tr>
<tr>
<td>Adjust belt tension</td>
</tr>
<tr>
<td>Check and correct sheave alignment</td>
</tr>
<tr>
<td>Close and secure door</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses</td>
</tr>
<tr>
<td>Pinch points</td>
</tr>
<tr>
<td>No finger rings</td>
</tr>
<tr>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>[Report all injuries]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine belt condition</td>
</tr>
<tr>
<td>Determine sheave condition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard preventative maintenance schedule</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
### MAINTAIN VEE BELT DRIVE

<table>
<thead>
<tr>
<th><strong>SCIENCE</strong></th>
<th><strong>MATH - NUMBER SYSTEMS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (pulleys)</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines (friction)</td>
<td></td>
</tr>
<tr>
<td>Effects of heating and cooling on expansion of materials</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Effect of friction on work processes and product quality (friction)</td>
<td></td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape (stretching)</td>
<td></td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th><strong>PERFORMANCE MODES</strong></th>
<th><strong>EXAMPLES</strong></th>
<th><strong>SKILLS/CONCEPTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty J  Inspecting, Repairing, and Maintaining Centrifugal Clutch

1. Inspect centrifugal clutch
2. Repair centrifugal clutch
3. Maintain centrifugal clutch
<table>
<thead>
<tr>
<th><strong>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</strong></th>
<th><strong>PERFORMANCE KNOWLEDGE</strong></th>
<th><strong>SAFETY – HAZARD</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Run system</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Strobotac</td>
<td>Check with strobotac (slippage)</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Two indicators</td>
<td>Check alignment</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Inspection mirror</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiping cloth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DECISIONS</strong></th>
<th><strong>CUES</strong></th>
<th><strong>ERRORS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine repairs needed</td>
<td>Condition of equipment, slippage, alignment, heat, smoke</td>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
### ASK STATEMENT
**Inspect Centrifugal Clutch**

<table>
<thead>
<tr>
<th><strong>Science</strong></th>
<th><strong>Math – Number Systems</strong></th>
</tr>
</thead>
</table>
| Newton's laws of motion (1-3)  
Centrifugal forces developed by bodies in rotation  
Transfer of energy from one form to another  
Inertia and momentum | Operating condition |

### Communications

#### Performance Modes
- **Reading**
- **Speaking**
- **Viewing**
- **Listening**
- **Touching**

#### Examples
- Inspection order
- Instructions to operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### Skills/Concepts
- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
### Tool, Equipment, Materials, Objects Acted Upon
- Socket head wrenches
- Flash light
- Wiping cloth
- Strobotac
- Friction tape
- Feeler gauges

### Performance Knowledge
- Lock and secure main switch
- Loosen set screws on rim
- Slide rim toward motor and shaft
- Remove old drive blocks
- Align clutch driver and clutch
- Install new matched blocks in pairs at 180°
- Return rim and secure
- Run and check for slippage
- Dispose of all parts

### Safety - Hazard
- Safety glasses
- Pinch points
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### Decisions
- Determine whether to repair or replace worn blocks

### Cues
- Slippage
- Fatigue of block
- Hot rim-clutch
- Life span of equipment
- Smoke

### Errors
- Machine failure under load
**ASK STATEMENT**

**REPAIR CENTRIFUGAL CLUTCH**

<table>
<thead>
<tr>
<th><strong>SCIENCE</strong></th>
<th><strong>MATH - NUMBER SYSTEMS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Newton's Laws of motion (1-3)</td>
<td></td>
</tr>
<tr>
<td>- Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>- Centrifugal forces developed by bodies in rotation</td>
<td></td>
</tr>
<tr>
<td>- Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>- Effects of friction on work processes and product quality (friction)</td>
<td></td>
</tr>
<tr>
<td>- Measure of time and speed</td>
<td></td>
</tr>
<tr>
<td>- Measure of weight</td>
<td></td>
</tr>
<tr>
<td>- Measures of temperature</td>
<td></td>
</tr>
<tr>
<td>- Operating dimensions</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th><strong>PERFORMANCE MODES</strong></th>
<th><strong>EXAMPLES</strong></th>
<th><strong>SKILLS/CONCEPTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading</strong></td>
<td>Repair service order</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parts and repair manual</td>
<td></td>
</tr>
<tr>
<td><strong>Speaking</strong></td>
<td>Instructions to operator</td>
<td></td>
</tr>
<tr>
<td><strong>Writing</strong></td>
<td>Requisition of parts</td>
<td></td>
</tr>
<tr>
<td><strong>Viewing</strong></td>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension, detail/inference, trade terminology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description of mechanism, definition, instructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Penmanship, spelling, classification, terminology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visual analysis, describing, logic, detail/inference</td>
<td></td>
</tr>
</tbody>
</table>
### MAINTAIN CENTRIFUGAL CLUTCH

#### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Socket head wrenches
- Flashlight
- Air hose
- Blow gun
- Strobotac

#### PERFORMANCE KNOWLEDGE
- Lock and secure main switch
- Remove flange
- Blow out dust and dirt
- Check blocks, (must be free)
- Check and tighten set screws
- Install flange
- Run and check for slippage

#### SAFETY – HAZARD
- Safety glasses
- Goggles
- Flying dust from compressed air
  - [Smoking not permitted where flammable liquids and paint are being used/stored or pos ed]
  - [Report all injurie s]

#### DECISIONS
- Determine maintenance services to perform

#### CUES
- Standard preventative maintenance schedule

#### ERRORS
- Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Newton's Laws of Motion  
Centrifugal forces developed by bodies in rotation  
Transfer of energy from one form to another  
Inertia and momentum  
Friction makes heat and debris | Operating conditions |

### Communications

**Performance Modes**
- Reading
- Speaking
- Viewing

**Examples**
- Preventative maintenance schedule
- Instructions to operator
- Equipment

**Skills/Concepts**
- Comprehension, detail/inference, description of mechanism, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
Duty K Inspecting, Repairing, and Maintaining Pneumatic Clutch and Brake

1. Inspect pneumatic clutch and brake
2. Repair pneumatic clutch
3. Maintain pneumatic clutch
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Shut-off machine</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Observe for excessive grease</td>
<td>Caution - moving machinery</td>
</tr>
<tr>
<td>Belt tension tester</td>
<td>Frayed wiring</td>
<td>Caution - slips and falls</td>
</tr>
<tr>
<td>Air gauge</td>
<td>Inspect air hose, and air valve</td>
<td>Grease spills</td>
</tr>
<tr>
<td></td>
<td>Check belts through inspections hole</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td>for wear and tension</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>Inspect clutch and brake pads for wear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check lubrication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Request operator to &quot;dry run&quot; machine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Look and listen for faulty operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check limit switches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examine air hose with pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check air pressure</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine repairs needed</td>
<td>Condition of equipment</td>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
### ASK STATEMENT

**INSPECT PNEUMATIC CLUTCH AND BRAKE**

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<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (pulleys)</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency of simple machines (friction kinetic and potential)</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on wear process</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Newton's Laws of motion</td>
<td></td>
</tr>
<tr>
<td>Lubricants</td>
<td></td>
</tr>
<tr>
<td>Gas under pressure</td>
<td></td>
</tr>
<tr>
<td>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape (stretching)</td>
<td></td>
</tr>
</tbody>
</table>

---

### COMMUNICATIONS

**PERFORMANCE MODES**

- Reading
- Speaking
- Viewing
- Listening
- Touching

**EXAMPLES**

- Inspection order
- Instructions to operator
- Inspection equipment
- Operating equipment
- Surface and parts

**SKILLS/CONCEPTS**

- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratchet extension and sockets</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Remove cover plate</td>
<td>Grease, spills</td>
</tr>
<tr>
<td>Ball peen hammer</td>
<td>Block ram</td>
<td>Pinch points</td>
</tr>
<tr>
<td>New brake pads</td>
<td>Shut off air supply</td>
<td>Slips or falls</td>
</tr>
<tr>
<td>New clutch pads</td>
<td>Remove rotating air valve, solenoid valve, pad mounting housing, clutch pads, brake housing, and brake pads</td>
<td></td>
</tr>
<tr>
<td>Grease gun</td>
<td>Bell ring disc and housing</td>
<td></td>
</tr>
<tr>
<td>Grease</td>
<td>Install brake pads, brake housing, clutch pads, clutch housing, rotating air valve, and solenoid valve</td>
<td></td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Lubricate bearings</td>
<td>Caution on compressed air</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Check air pressure</td>
<td>Smoking not permitted where flammable liquids and paint are being used/stored or posted</td>
</tr>
<tr>
<td>Extension cord and light</td>
<td>Turn on air</td>
<td>Report all injuries</td>
</tr>
<tr>
<td>Timber and blocking</td>
<td>Remove blocking</td>
<td></td>
</tr>
<tr>
<td>Sling and hoist</td>
<td>Run and check operation</td>
<td></td>
</tr>
<tr>
<td>Air pressure gauge</td>
<td>Install cover plates</td>
<td></td>
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</tbody>
</table>

**DECISIONS**

Determine whether to repair or replace clutch parts

**CUES**

Condition and life span of parts

**ERRORS**

Lack of transmitted power
Ram drifts
Weak ram thrust
Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (pulleys) Work input, work output, friction and efficiency in simple machines (friction kinetic and potential) Effects of friction on work processes and product quality Inertia and momentum Newton's Laws of Motion Lubricants <strong>Gas under pressure</strong> Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape (stretching) Effects of lubricants</td>
<td>Operating dimensions</td>
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<td><strong>PERFORMANCE MODES</strong></td>
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<tr>
<td>Writing</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
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<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
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<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Grease gun</td>
</tr>
<tr>
<td>Grease</td>
</tr>
<tr>
<td>Flashlight</td>
</tr>
<tr>
<td>End wrenches</td>
</tr>
<tr>
<td>Air pressure gauge</td>
</tr>
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<td></td>
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</tbody>
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**DECISIONS**
- Determine maintenance services to perform

**CUES**
- Standard preventative maintenance schedules

**ERRORS**
- Machine failure under stress
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<td>Speaking</td>
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<tr>
<td>Viewing</td>
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</tbody>
</table>
Duty L  Inspecting, Repairing, and Maintaining Acme Feed Screw

1  Inspect acme feed screw
2  Repair acme-feed screw (milling machine)
3  Maintain acme feed screw (milling machine)
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Stop machine lock out</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Inspect lubrication</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td>Hand crank table to center</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>Work crank back and forth to denote looseness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect screw for burrs and roughness, sharp corners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check end play of screw</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine if repairs are needed</td>
<td>Condition of equipment</td>
<td>Machine failure under load</td>
</tr>
<tr>
<td></td>
<td>Rough finish out of tolerance on machined part</td>
<td></td>
</tr>
</tbody>
</table>
## Task Statement

**Inspect ACME Feed Screw**

### Science

- Simple machines used to gain mechanical advantage
- Work input, work output, friction and efficiency in simple machines
- Fluids under pressure
- Inertia and momentum (body at rest - body in motion)
- Effects of friction on work processes and product quality
- Resistance of materials to change in shape (resist to twisting, bending)
- Effects of lubricants

### Math - Number Systems

- Dimensional tolerance
- Operating dimensions

### Communications

#### Performance Modes

- **Reading**
- **Speaking**
- **Viewing**
- **Listening**
- **Touching**

#### Examples

- Inspection order
- Instructions to operator
- Inspect equipment
- Operating equipment
- Surface and parts

#### Skills/Concepts

- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
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<th>PERFORMANCE KNOWLEDGE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ratchet wrench and sockets</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Socket head set</td>
<td>Crank knee down</td>
<td>Pinch points</td>
</tr>
<tr>
<td>Oil</td>
<td>Crank saddle out</td>
<td>Only operator to load or unload machine</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Remove tooling from table</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Screwdrivers</td>
<td>Remove end brackets cranks, feed dials and bearings</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>A-frame on wheels</td>
<td>Remove feed screw</td>
<td></td>
</tr>
<tr>
<td>Sling</td>
<td>Remove table gib</td>
<td></td>
</tr>
<tr>
<td>Pick up clamps</td>
<td>Remove table</td>
<td></td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td>Remove feed nuts</td>
<td></td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Install new feed nuts</td>
<td></td>
</tr>
<tr>
<td>End wrenches</td>
<td>Replace table</td>
<td></td>
</tr>
<tr>
<td>Face spanner wrenches</td>
<td>Install gib and adjust</td>
<td></td>
</tr>
<tr>
<td>New feed screw</td>
<td>Install new feed screw and bearings</td>
<td></td>
</tr>
<tr>
<td>New feed nuts</td>
<td>Adjust feed nuts</td>
<td></td>
</tr>
<tr>
<td>New feed screw bearings</td>
<td>Lube screw and check operation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether to install new parts or repair</td>
<td>Feed screw and nuts</td>
<td>Machine failure under load</td>
</tr>
<tr>
<td></td>
<td>Condition and life span of parts</td>
<td></td>
</tr>
</tbody>
</table>
**ASK STATEMENT**

**REPAIR ACME FEED SCREW (MILLING MACHINE)**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [linear motion to rotary motion]</td>
<td></td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines [friction]</td>
<td></td>
</tr>
<tr>
<td>Fluids under pressure [lubricant]</td>
<td></td>
</tr>
<tr>
<td>Centrifugal force developed by bodies in rotation [body at rest - body in motion]</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape [stretching]</td>
<td></td>
</tr>
<tr>
<td>Wrench dimensions</td>
<td></td>
</tr>
<tr>
<td>Measures of length [measurement]</td>
<td></td>
</tr>
<tr>
<td>Operating dimensions</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parts and repair manual</td>
<td></td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Requisition for parts</td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension, detail/inference, trade terminology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description of mechanism, definition, instructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Penmanship, spelling, classification, terminology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visual analysis, describing, logic, detail/inference</td>
<td></td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Socket head wrench</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Screwdriver</td>
<td>Adjust screw linear looseness (end play)</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Hand crank table to extreme right</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Flashlight</td>
<td>Adjust feed nuts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hand crank table to extreme left</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check feed nuts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assure lubrication</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine maintenance service to perform

**CUES**

Standard preventative maintenance schedule

**ERRORS**

Machine failure under load
### TASK STATEMENT

**MAINTAIN ACME FEED SCREW (MILLING MACHINE)**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage  
Work input, work output, friction and efficiency in simple machines  
Fluids under pressure [lubricants]  
Inertia and momentum [bodies at rest - bodies in motion]  
Effects of friction on work processes and product quality  
Resistance of materials to change in shape  
Effects of lubricants | Wrench dimensions  
Measures of length [measurement]  
Operating dimensions |

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, discription of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail inference</td>
</tr>
</tbody>
</table>
Duty M  Inspecting, Repairing, and Maintaining Ball Nut Feed Screw

1  Inspect ball screw nut feed
2  Repair ball screw looseness
3  Maintain ball screw
# Task Statement

**Inspect Ball Screw Nut Feed**

## Tools, Equipment, Materials, Objects Acted Upon

- Flashlight
- Lint free wiping cloths
- Indicator

## Performance Knowledge

- Lock out main switch
- Wipe screw thread clean of oil and dirt
- Inspect screw thread for wear and roughness
- Indicate table for linear motion
- Inspect mounting screws
- Hand crank table end to end, feel for smooth operation
- Listen for unusual sounds (grinding)
- Check lubrication

## Safety – Hazard

- Safety glasses
- Clean lint free wiping cloth
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

## Decisions

- Determine repairs needed

## Cues

- Unusual sounds, condition of equipment

## Errors

- Machine failure under load
<table>
<thead>
<tr>
<th>TASK STATEMENT</th>
<th>INSPECT BALL SCREW BUT FEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH - NUMBER SYSTEMS</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td></td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td></td>
</tr>
<tr>
<td>Effect of friction - work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>Inspect ball screw IUT feed</td>
<td></td>
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<tr>
<td>Mathematics</td>
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<tr>
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<tr>
<th>Communications</th>
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<tbody>
<tr>
<td>Plus and minus on indicator</td>
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<td>Operating dimensions</td>
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<tr>
<td>Listening</td>
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<tr>
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<tr>
<td>Operating equipment</td>
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<tr>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Inspection of equipment</td>
</tr>
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<td>Inspection order</td>
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<tbody>
<tr>
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**TASK STATEMENT**  REPAIR BALL SCREW LOOSENESS

<table>
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<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
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<tbody>
<tr>
<td>Flashlight</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth (lint free)</td>
<td>Remove oil motor drive, driving coupling from screw, table end brackets</td>
<td>Slips from oil spills</td>
</tr>
<tr>
<td>Ratchet and sockets</td>
<td>Secure ball nut on ball screw (wire, cloth)</td>
<td>Handle assembly carefully</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Remove ball nut bolts from table, assembly of screw and ball nuts, and bolts from nut halves and remove dowels</td>
<td>Secure ball nut or it will windmill (mashed fingers)</td>
</tr>
<tr>
<td>Indicator with magnetic base</td>
<td>Move slightly to remove spacer</td>
<td>No rings</td>
</tr>
<tr>
<td>Screwdrivers</td>
<td>Grind spacer to desired thickness</td>
<td>Clean, lint-free wiping cloth</td>
</tr>
<tr>
<td>Hammer</td>
<td>Reinstall spacer, dowles and bolts</td>
<td>Smoking not permitted where flammable liquids and paint are being used/stored or posted</td>
</tr>
<tr>
<td>Horses (wood topped)</td>
<td>Use dial indicator to verify looseness</td>
<td>Report all injuries</td>
</tr>
<tr>
<td>Micrometer outside 0”-1”</td>
<td>Remove all looseness by regrinding spacer; reinstall screw assembly and end brackets</td>
<td></td>
</tr>
<tr>
<td>Depth micrometer</td>
<td>Remove one bearing thrust plate and grind to desired length; reinstall and check for end play of screws</td>
<td></td>
</tr>
<tr>
<td>Wire</td>
<td>Reinstall oil motor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manually operate automatic lubricator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check for operation</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine adjustment

Loose ball screw

**CUES**

Condition and life span of parts

**ERRORS**

Wear from usage
### TASK STATEMENT

**REPAIR BALL-SCREW LOoseness**

### SCIENCE

<table>
<thead>
<tr>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials [heat, change of dimensions]</td>
</tr>
<tr>
<td>Fluids under pressure [oil under pressure]</td>
</tr>
<tr>
<td>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [hardness]</td>
</tr>
<tr>
<td>Transfer of energy from one form to another [from oil pressure to linear measurement]</td>
</tr>
<tr>
<td>Inertia and momentum</td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
</tr>
<tr>
<td>Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [structure rearrangement]</td>
</tr>
<tr>
<td>Resistance of materials to change in shape</td>
</tr>
<tr>
<td>Effects of lubrication</td>
</tr>
</tbody>
</table>

### MATH - NUMBER SYSTEMS

<table>
<thead>
<tr>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures of length [decimal]</td>
</tr>
<tr>
<td>Wrench dimensions</td>
</tr>
<tr>
<td>Operating dimension</td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Speaking</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
</tbody>
</table>

### EXAMPLES

<table>
<thead>
<tr>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair service order</td>
</tr>
<tr>
<td>Parts and repair manual</td>
</tr>
<tr>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Requisition of parts</td>
</tr>
<tr>
<td>Equipment</td>
</tr>
</tbody>
</table>

### SKILLS/CONCEPTS

<table>
<thead>
<tr>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
### TASK STATEMENT

**MAINTAIN BALL SCREW**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
</tr>
<tr>
<td>Wiping cloth (lint free)</td>
</tr>
<tr>
<td>Ratchet wrench and sockets</td>
</tr>
<tr>
<td>Socket head wrenches</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock out main switch</td>
</tr>
<tr>
<td>Wipe screw clean</td>
</tr>
<tr>
<td>Adjust lubricator</td>
</tr>
<tr>
<td>Tighten ball nut mounting screws</td>
</tr>
<tr>
<td>Tighten end plate mounting screws</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses</td>
</tr>
<tr>
<td>Slips on oil spills</td>
</tr>
<tr>
<td>Clean lint free wiping cloth</td>
</tr>
<tr>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>[Report all injuries]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine maintenance services to perform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard preventative maintenance schedule</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
**TASK STATEMENT**  MAINTAIN BALL SCREW

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Wrench dimensions</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials [change of dimensions]</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Liquids under pressure [oil under pressure]</td>
<td></td>
</tr>
<tr>
<td>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
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</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td></td>
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<tr>
<td>Resistance of materials to change in shape</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty N
Inspecting, Repairing, and Maintaining Fluid Feed Screw

1. Inspect fluid feed screw (oil cylinder)
2. Repair fluid feed screw oil cylinder (milling machine)
3. Maintain fluid feed screw (oil cylinder) milling machine
**TASK STATEMENT**  
**Inspect Fluid Feed Screw (Oil Cylinder)**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
</table>
| Wiping cloth  
Flashlight  
Ratchet wrench and sockets  
Socked head wrenches (Allen) | Remove both aprons  
Operate table from end to end  
Inspect for leaks  
Inspect piston rod for scores and nicks  
Inspect hold down bolts | Safety glasses  
[Smoking not permitted where flammable liquids and paint are being used/stored or posted]  
[Report all injuries] |

**DECISIONS**
- Determine repairs needed

**CUES**
- Condition of equipment, leaks, scores, nicks

**ERRORS**
- Machine failure under load
**ASK STATEMENT**

**INSPECT FLUID FEED SCREW (OIL CYLINDER)**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Wrench dimensions</td>
</tr>
<tr>
<td>Fluids under pressure</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Forces acting on a body immersed or floating in a liquid</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum [Pascal's Law]</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
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<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instruction to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
</tbody>
</table>
### Tools, Equipment, Materials, Objects Acted Upon
- Socket head wrenches
- End wrenches
- Tubing box wrench
- Screwdrivers
- Wiping cloths
- Spedi-dri
- Flashlight
- Cylinder rod seal

### Performance Knowledge
- Remove table apron - rod end
- Move table to expose piston rod and cylinder end
- Lock out main switch
- Unbolt piston rod from bracket on frame
- Loosen fitting on hydro line on opposite end of cylinder
- Push piston rod clear of bracket
- Remove seal gland and oil seal
- Install new seal
- Reinstall gland
- Reinstall piston rod in end bracket
- Tighten loosened oil line fitting
- Start machine
- Operate machine end to end
- Bleed air from cylinder - both ends
- Start machine check for operation, leaks
- Reinstall table apron

### Safety – Hazard
- Safety glasses
- Caution - working on moving machinery
- Slips from oil spills or leaks
- Do not attempt to take dimensions while machine is in motion
- When using knives, screwdrivers or any cutting tool do not direct the strain toward self or another employee
- Do not use screwdrivers as chisels or pry bars
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### Decisions
- Determine whether to install new seal

### Cues
- Condition and lifespan of parts

### Errors
- Constant usage
- Leakage
- Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Work input, work output, friction and efficiency in simple machines  
Fluids under pressure  
Forces acting on a body immersed or floating in a liquid  
Transfer of energy from one form to another  
Inertia and momentum  
Pascal's Law  
Effects of lubricants | Wrench dimensions  
Number of oil seal  
Operating dimensions |

### COMMUNICATIONS

#### PERFORMANCE MODES
- **Reading**
- **Speaking**
- **Writing**
- **Viewing**

#### EXAMPLES
- Repair service order  
- Parts and repair manuals  
- Instructions to operator  
- Requisition for parts  
- Equipment

#### SKILLS/CONCEPTS
- Comprehension, detail/inference, trade terminology  
- Description of mechanism, definition, instructions  
- Trade terminology, enunciation, clarity of expression, logic  
- Penmanship, spelling, classification, terminology  
- Visual analysis, describing, logic, detail/inference
### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Socket head wrenches
- Ratchet wrench and sockets
- Flashlight
- Wiping cloth

### PERFORMANCE KNOWLEDGE
- Operate table end to end
- Remove apron on both ends
- Observe for leakage
- Stop leaks
- Tighten hold down bolts
- Reinstall aprons

### SAFETY - HAZARD
- Safety glasses
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### DECISIONS
- Determine maintenance service to perform

### CUES
- Standard preventative maintenance schedule

### ERRORS
- Machine failure under load
### TASK STATEMENT

**MAINTAIN FLUID FEED SCREW (OIL CYLINDER) MILLING MACHINE**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
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<tr>
<td>Fluids under pressure</td>
<td></td>
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<td>Forces acting on a body immersed or floating in a liquid</td>
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<tr>
<td>Transfer of energy from one form to another</td>
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<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Pascal's Law</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricant</td>
<td></td>
</tr>
<tr>
<td>Wrench dimensions</td>
<td></td>
</tr>
<tr>
<td>Operating dimensions</td>
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</table>

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<th>SKILLS/CONCEPTS</th>
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<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td></td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visual analysis, describing, logic, detail/inference</td>
<td></td>
</tr>
</tbody>
</table>
Duty O: Inspecting, Repairing, and Maintaining Anti-Friction Bearings

1. Inspect anti-friction bearing (roller or ball)
2. Repair anti-friction bearing (roller or ball)
3. Maintain anti-friction bearing (roller or ball)
## Task Statement
**Inspect Anti-Friction Bearing (Roller or Ball)**

### Tools, Equipment, Materials, Objects Acted Upon
- Flashlight
- Wiping cloth
- Contact thermometer
- Aligning bar (straight edge)

### Performance Knowledge
- Inspect lubrication
- Check for excessive heat
- Check for excessive vibration
- Check for excessive noise

### Safety - Hazard
- Safety glasses
- Grease on floor
- Caution: rotating shaft
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### Decisions
- Determine repairs needed

### Cues
- Condition of equipment, temperature, noise, vibration

### Errors
- Machine failure under load
### SCIENCE
- Simple machines used to gain mechanical advantage (pulleys)
- Work input, work output, friction and efficiency in simple machines (friction)
- Effect of heating and cooling on expansion of materials
- Fluids under pressure (lube)
- Inertia and momentum
- Effects of friction on work processes and product quality
- Effects of lubrication

### MATH – NUMBER SYSTEMS
- Basic math skills (read thermometer)
- Operating dimensions

### COMMUNICATIONS
#### PERFORMANCE MODES
- **Reading**
  - Inspection order
- **Speaking**
  - Instructions to operator
- **Viewing**
  - Inspect equipment
- **Listening**
  - Operating equipment
- **Touching**
  - Surface and parts

#### EXAMPLES
- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
## TASK STATEMENT
REPAIR ANTI-FRICTION BEARING (ROLLER OR BALL)

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Ratchet wrench and sockets
- Socket bead wrenches
- Flashlight
- Wiping cloth
- Stoddard solvent
- Jack
- Timber
- File
- Emory cloth
- Oil
- Surface thermometer

### PERFORMANCE KNOWLEDGE
- Lock out main switch
- Jack up bearing shaft and block
- Remove bearing
- Clean and inspect bearing for possible reuse
- Reinstall old bearing if possible to reuse
- Lower shaft, secure bearing mount
- Check and adjust alignment
- Lubricate
- Run and check operation
- Feel for heat
- Feel for vibrations
- Listen for unusual noise

### SAFETY – HAZARD
- Safety glasses
- Pinch points
- Splinters from timber (wear gloves)
- [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
- [Report all injuries]

### DECISIONS
Determine whether to reuse or replace bearing

### CUES
- Dirty, noisy, heat
- Lack of lube
- Life span of parts
- Expense of bearing

### ERRORS
- Machine failure under load
- Unnecessary expense
## TASK STATEMENT
REPAIR ANTI-FRICTION BEARING (ROLLER OR BALL)

### SCIENCE
- Simple machines used to gain mechanical advantage [pulley]
- Work input, work output, friction and efficiency in simple machines
- Effect of heating and cooling on expansion of materials [expansion due to heat]
- Fluids under pressure [proper lube]
- Inertia and momentum
- Effects of friction on work processes and product quality
- Effects of lubrication

### MATH - NUMBER SYSTEMS
- Wrench dimensions
- Measures of length
- Measures of temperature [bearings]
- Liquid and dry measures [oil]
- Operating dimensions

### COMMUNICATIONS

#### PERFORMANCE MODES
- Reading
- Speaking
- Writing
- Viewing

#### EXAMPLES
- Repair service order
- Parts and repair manual
- Instructions to operator
- Requisition for parts
- Equipment

#### SKILLS/CONCEPTS
- Comprehension, detail/inference, trade terminology
- Description of mechanism, definition, instructions
- Trade terminology, enunciation, clarity of expression, logic
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Wip off exterior</td>
<td>Grease on floor</td>
</tr>
<tr>
<td>Lubricant</td>
<td>Lubricate bearing</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Ratchet wrench and sockets</td>
<td>Loosen bearing bolts</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Align bearing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tighten mounting bolts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Run and check</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine maintenance services to perform

**CUES**
- Standard preventative maintenance schedule

**ERRORS**
- Machine failure under load
**ASK STATEMENT**  MAINTAIN ANTI-FRICTION BEARING (ROLLER OR BALL)

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage [pulley] 
Work input, work output, friction and efficiency in simple machines 
Effect of heating and cooling on expansion of material [expansion due to heat] 
Fluids under pressure [lube] 
Inertia and momentum 
Effects of friction on work processes and product quality 
Effects of lubricants | Wrench dimensions 
Operating dimensions |

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
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<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty P  Inspecting, Repairing, and Maintaining Control Systems

1  Inspect control system (linkage and levers)
2  Repair control systems (linkage and levers)
3  Maintain control system (linkage and levers)
### Task Statement

**Inspect Control System Linkage and Levers**

### Tools, Equipment, Materials, Objects Acted Upon
- Flashlight
- Wiping cloth

### Performance Knowledge
- Shut off machine
- Hand operate levers
- Feel for looseness
- Visually inspect pins, levers for deformations (wear, twist, bends)
- Start machine
- Feel for looseness
- Listen for vibrations and rattles

### Safety - Hazard
- Safety glasses
- [Smoking not permitted where flammable liquids and paint are being stored/used or posted]
- [Report all injuries]

### Decisions
- Determine repairs needed

### Cues
- Condition of equipment

### Errors
- Machine failure under load
### Task Statement

**Inspect Control System Linkage and Levers**

<table>
<thead>
<tr>
<th>Science</th>
<th>Math - Number Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (levers and linkage) Effects of lubricants</td>
<td>Basic math skills Operating dimensions</td>
</tr>
</tbody>
</table>

### Communications

<table>
<thead>
<tr>
<th>Performance Modes</th>
<th>Examples</th>
<th>Skills/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Inspection order Instructions to operator Inspect equipment Operating equipment Surface and parts</td>
<td></td>
</tr>
<tr>
<td>Speaking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
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<td></td>
</tr>
<tr>
<td>Listening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Touching</td>
<td></td>
<td></td>
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</tbody>
</table>

- Comprehension, detail/inference, trade terminology
- Trade terminology, enunciation, clarity of expression, logic
- Visual analysis, describing, logic, detail/inference
- Auditory discrimination, concentration, noise discrimination
- Shape, texture, movement, tension
<table>
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<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
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</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Ratchet wrench and sockets</td>
<td>Dismantle levers, pins, linkage, fork and bar shifter and pinions gears, and quadrant gear shifter</td>
<td>Pinch points</td>
</tr>
<tr>
<td>Socket head wrenches</td>
<td>Drill and ream levers and linkage</td>
<td>Report all injuries</td>
</tr>
<tr>
<td>Electric drill</td>
<td>Install oversized pins and cotter keys</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/ stored or posted]</td>
</tr>
<tr>
<td>High speed drills</td>
<td>Straighten shifting levers</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Reamers (rose type)</td>
<td>Linkage and fork</td>
<td></td>
</tr>
<tr>
<td>Pliers</td>
<td>Replace sleeve bearings as required</td>
<td></td>
</tr>
<tr>
<td>Ball peen hammer</td>
<td>Check spring, de tent tooth and slot</td>
<td></td>
</tr>
<tr>
<td>Oil can</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anvil or steel plate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotter keys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oversize linkage pins</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether to repair or place parts</td>
<td>Condition and lifespan of parts</td>
<td>Machine failure under load</td>
</tr>
</tbody>
</table>
### Science

<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [levers, linkage]</td>
<td></td>
</tr>
<tr>
<td>Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another [spring]</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality [detent]</td>
<td></td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body [spring]</td>
<td></td>
</tr>
<tr>
<td>Resistance of materials to change in shape [spring compression]</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricant</td>
<td></td>
</tr>
</tbody>
</table>

### Math - Number Systems

- Basic math skills
- Wrench sizes dimensions
- Drill sizes
- Reamer sizes
- Operating dimensions

### Communications

#### Performance, Modes

- **Reading**
  - Repair service order
  - Parts and repair-manual
- **Speaking**
  - Instructions to operator
- **Writing**
  - Requisition for parts
- **Viewing**
  - Equipment

#### Examples

- Repair service order
- Parts and repair-manual
- Instructions to operator
- Requisition for parts
- Equipment

#### Skills/Concepts

- Comprehension, detail/inference, trade terminology
- Description of mechanism, definition, instructions
- Trade terminology, enunciation, clarity of expression, logic
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
<table>
<thead>
<tr>
<th>TOOLS; EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Shut off machine</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Oil can</td>
<td>Lubricate linkage and pins</td>
<td>Oil spills</td>
</tr>
<tr>
<td>Oil</td>
<td>Start machine and actuate lever in all positions</td>
<td>Slips and falls</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Check for correct operation: linkage pins, cotter keys</td>
<td>Pinch points</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine maintenance services to perform

**CUES**
Standard preventative maintenance schedule

**ERRORS**
Machine failure under load

[Smoking not permitted where flammable liquids and paint are being stored/used or posted]
[Report all injuries]
**ASK STATEMENT**

**MAINTAIN CONTROL SYSTEM (LINKAGE AND LEVERS)**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [levers and linkage] Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [hardness] Effects of lubricants</td>
<td>Basic math skills Operating dimensions</td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Preventative maintenance schedule</td>
<td>Comprehension, detail/inference, description of mechanism, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
Duty Q  Inspecting, Repairing, and Maintaining Hydraulic, Pneumatic, and Vacuum Components and Systems

1. Inspect hydraulic, pneumatic, vacuum components and systems
2. Repair hydraulic, pneumatic, vacuum components and systems
3. Maintain hydraulic, pneumatic, vacuum components and systems
**TASK STATEMENT**

**INSPECT HYDRAULIC, PNEUMATIC, VACUUM COMPONENTS AND SYSTEMS**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Operate system, at full capacity</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Inspect flow and pressures</td>
<td>[Smoking not permitted where flammable liquids and paint are being stored/used or posted]</td>
</tr>
<tr>
<td>Foxboro recorder</td>
<td>Inspect for leaks</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td></td>
<td>Inspect hose for wear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect safety cables on high pressure hoses and lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect all fittings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect drive belts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect pulleys for wear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect lubricants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect for smooth operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hand check for vibration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check hold down bolts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check hour meters time factor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Listen for unusual noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check vacuum systems</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine repairs needed

**CUES**

Condition of equipment

**ERRORS**

Machine failure under load
### Task Statement

Inspect hydraulic, pneumatic, vacuum components and systems

<table>
<thead>
<tr>
<th>Science</th>
<th>Math - Number Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (gears, pulleys)</td>
<td>Basic math skills</td>
</tr>
<tr>
<td>Conversion of pressure of fluids and gases to linear or rotary motions</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

### Communications

<table>
<thead>
<tr>
<th>Performance Modes</th>
<th>Examples</th>
<th>Skills/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Inspection order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Viewing</td>
<td>Inspection of equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Listening</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td>Touching</td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
</tbody>
</table>

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### Tools, Equipment, Materials, Objects Acted Upon

<table>
<thead>
<tr>
<th>Item</th>
<th>Performance Knowledge</th>
<th>Safety - Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test gauges (master)</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Flow meter</td>
<td>Remove cover plate from reservoir</td>
<td>Pinch points</td>
</tr>
<tr>
<td>Miss hardware (pipe fittings, etc.)</td>
<td>Clean interior; clean and/or replace filter; check and replace as required: all tubing, piping and fittings</td>
<td>Oil spills</td>
</tr>
<tr>
<td>Filter elements</td>
<td>Replace cover</td>
<td>Caution: high pressure on air and oil lines</td>
</tr>
<tr>
<td>O-rings</td>
<td>Remove and dismantle valves; replace defective parts; reassemble and install valves</td>
<td>Smoking not permitted where flammable liquids and paint are being used/stored or posted</td>
</tr>
<tr>
<td>Ratchet wrench set</td>
<td>Remove pump and disassemble; replace defective parts; reassemble and install</td>
<td>Report all injuries</td>
</tr>
<tr>
<td>Socket head wrench set</td>
<td>Calibrate pressure gauges</td>
<td></td>
</tr>
<tr>
<td>End wrench set</td>
<td>Refill lubrication system and hydraulic system, if required; bleed air from hydraulic lines; run system and check flow and pressures; visually check accumulators, actuators, seals, safety controls, receivers, mufflers, fans fittings, drive and general conditions</td>
<td></td>
</tr>
<tr>
<td>Screwdrivers</td>
<td>Blow out heat exchanger and check system</td>
<td></td>
</tr>
<tr>
<td>Ball peen hammer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube cutter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hack saw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Putty knife</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoddard solvent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiping cloths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergy cloth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sealant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taper pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil can and oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foxboro recorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air hose and blow gun</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Decisions

Determine whether to repair or replace defective parts

### Cues

- Hour meter, dust, dirt, normal wear, leaks

### Errors

- Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [levers, gears, pulleys]</td>
<td>Basic math skills</td>
</tr>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Wrench dimensions</td>
</tr>
<tr>
<td>Fluids under pressure</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Transfer of energy from one form to another</td>
<td></td>
</tr>
<tr>
<td>Transfer of heat from one body to another</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Repair service order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking</td>
<td>Parts and repair manual</td>
</tr>
<tr>
<td>Writing</td>
<td>Instructions to operator</td>
</tr>
<tr>
<td>Viewing</td>
<td>Requisition of parts</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
</tr>
</tbody>
</table>

#### EXAMPLES

- Repair service order
- Parts and repair manual
- Instructions to operator
- Requisition of parts
- Equipment

#### SKILLS/CONCEPTS

- Comprehension, detail/inference, trade terminology
- Description of mechanism, definition, instructions
- Trade terminology, enunciation, clarity of expression, logic
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
## TASK STATEMENT

**MAINTAIN HYDRAULIC, PNEUMATIC, VACUUM COMPONENTS AND SYSTEMS**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>Lock out main switch</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Wiping cloth</td>
<td>Remove, clean or replace external filter</td>
<td>Pinch points</td>
</tr>
<tr>
<td>End wrenches</td>
<td>Check belt drives</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>Hydraulic oil</td>
<td>Adjust tension</td>
<td>[Report all injuries]</td>
</tr>
<tr>
<td>Lube oil</td>
<td>Lube variable belt adjustments</td>
<td></td>
</tr>
<tr>
<td>Grease gun</td>
<td>Check all fittings</td>
<td></td>
</tr>
<tr>
<td>Fox boro recorder</td>
<td>Check all hose</td>
<td></td>
</tr>
<tr>
<td>Test gauges (master)</td>
<td>Tighten as required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check pressure gauges, correct errors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check flows, correct errors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check all valves, replace packing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check oil for viscosity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check oil for contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refill hydraulic oil if required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check vacuum for leaks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bleed air from hydraulic system</td>
<td></td>
</tr>
</tbody>
</table>

## DECISIONS

- Determine maintenance service to perform

## CUES

- Standard preventative maintenance

## ERRORS

- Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
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</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [levers, gears, pulleys and belts]</td>
<td>Basic math skills</td>
</tr>
<tr>
<td>Work input, machines</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td></td>
</tr>
<tr>
<td>Fluids under pressure [transfer of pressure]</td>
<td></td>
</tr>
<tr>
<td>Transfer of energy from one form to another [gas under pressure]</td>
<td></td>
</tr>
<tr>
<td>Inertia and momentum</td>
<td></td>
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<td>Effects of friction on work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body [packing and O-rings]</td>
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</tr>
<tr>
<td>Resistance of materials to change in shape</td>
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</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE MODES</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Speaking</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
</tbody>
</table>
Duty R  Inspecting, Repairing, and Maintaining Installation Machinery

1  Install machinery
### INSTALL MACHINERY

#### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Thermometer (contact)
- Levels (spirit)
- Plumb bobs
- Bronson or Wild optical transit
- Snips
- Shim stock
- Stoddard solvent
- Wiping cloth
- Putty knife

#### PERFORMANCE KNOWLEDGE
- Uncrate machine, assist setting on foundation; clean exterior
- Level machine with spirit level and/or optical transit
- Cut shim stock
- Tighten hold down bolts
- Recheck for level, adjust accordingly
- Lubricate machine; check all movements and for missing parts (bill of lading)
- Adjust tension on drive belts
- Start machine, run four hours at medium speed
- Check bearings for heat, gear box oil, for all tools, for parts manual, for operators manual, and for smooth operating conditions
- Operate at speeds and feeds
- Check all trips and stop dogs, automatic movement reversals and automatic lubers
- Check for safety features

#### SAFETY – HAZARD
- Safety glasses
- Smoking not permitted where flammable liquids and paint are being used/stored or posted
- Report all injuries

#### DECISIONS
- Determine adjustments needed

#### CUES
- Operation of machinery

#### ERRORS
- Machine failure under load
### (Task Statement) Install Machinery

<table>
<thead>
<tr>
<th>Science</th>
<th>Math - Number Systems</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage [gear, levers]  
Work input, work output, friction and efficiency in simple machines  
Effects of heating and cooling on expansion of materials  
Fluids under pressure  
Effects of lubricants | Operating dimensions |

### Communications

<table>
<thead>
<tr>
<th>Performance Modes</th>
<th>Examples</th>
<th>Skills/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Installation order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Speaking</td>
<td>Parts and operators manual</td>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Viewing</td>
<td>Instructions to operator</td>
<td>Trade terminology, enunciation, clarity of expression, logic</td>
</tr>
<tr>
<td>Listening</td>
<td>Inspect equipment</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Touching</td>
<td>Operating equipment</td>
<td>Auditory discrimination, concentration, noise discrimination</td>
</tr>
<tr>
<td></td>
<td>Surface and parts</td>
<td>Shape, texture, movement, tension</td>
</tr>
</tbody>
</table>
Duty S  Inspecting, Repairing, and Maintaining Service Bearings

1  Replace bearing (sleeve)
## REPLACE BEARING (SLEEVE)

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Scrapers
- Oil stone
- Hi-spot prussian blue
- Oil
- Timber
- Ratchet wrench
- Wiping cloth

### PERFORMANCE KNOWLEDGE
- Secure drive mechanism
- Loosen bolts in bearing block
- Raise shaft slightly
- **Remove bearing block**
- Remove sleeve from block
- Place prussian blue on shaft
- Slide new bearing on shaft
- Lower shaft
- Rotate shaft
- Remove bearing and scrape, clean shaft
- Clean bearing
- Lube shaft and bearings
- Reassemble
- Run and check

### SAFETY – HAZARD
- Safety glasses
- Caution - sharp tools
- Pinch points
- Do not use cotton waste or dirty cloths to wipe bearings
- Do not use incorrect kind of lubricant
  - [Smoking not permitted where flammable liquids and paint are being used/stored or posted]
  - [Report all injuries]

### DECISIONS
- Determine whether to repair or replace bad bearing

### CUES
- Excess oil leakage
- Looseness
- Vibration

### ERRORS
- Machine failure under load
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricant</td>
<td>Measures of length [length ID and OD]</td>
</tr>
<tr>
<td>Sae-Numbers and meanings</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Transfer of heat from one body to another</td>
<td></td>
</tr>
<tr>
<td>Effects of friction on work processes and product quality</td>
<td></td>
</tr>
<tr>
<td>Effects of lubricants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Repair service order</td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td></td>
<td>Parts and repair manual</td>
<td>Description of mechanism, definition, instructions</td>
</tr>
<tr>
<td>Writing</td>
<td>Requisition of parts</td>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>Equipment</td>
<td>Visual analysis, describing, logic detail/inference</td>
</tr>
</tbody>
</table>
Duty T  Inspecting, Repairing, and Maintaining Weld Shaft Padding
1  Weld-build up shaft by padding
(TASK STATEMENT) WELD-BUILD UP SHAFT BY PADDING

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc welder, Helmet, Electrodes, Chipping hammer, Wire brush, Vee blocks</td>
<td>Clean shaft, Position shaft on vee blocks, Acquire type of metal of shaft, Acquire correct electrode, Set proper amperage, Weld in proper sequence, Chip slag and brush each bead of weld, Overlap each bead 1/3, Check porosity, visually inspect, Rinse with dilute solution of nitric acid, Machine welded sections back to original dimensions</td>
<td>Safety glasses, Leather gloves, Protective clothing, Always pour acid into water, Keep welding stubs off floor, Check for flammable material before welding, Have water type extinguisher, Curtain to protect others from arc rays, Faceshield, rubber gloves and apron, [Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine if surface is worn</td>
<td>Frozen bearing</td>
<td>Machine failure</td>
</tr>
</tbody>
</table>
### Science

- Effect of heating and cooling on expansion of material
- Transfer of heat from one body to another
- Effects of friction on work processes and product quality
- Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements
- Electrode: tensile strength, yield point, elongation, melt off rate
- Cohesion
- Adhesion

### Math - Number Systems

- Measurement of length
- Read and interpret charts, tables, and/or graphs [charts for amperage settings]
- Operating dimensions

### Communications

#### Performance Modes

- Reading
  - Repair service order
- Writing
  - Parts and repair manual
- Viewing
  - Requisition for parts
  - Equipment

#### Examples

- Repair service order
- Parts and repair manual
- Requisition for parts
- Equipment

#### Skills/Concepts

- Comprehension, detail/inference, trade terminology
- Description of mechanism, definition, instructions
- Penmanship, spelling, classification, terminology
- Visual analysis, describing, logic, detail/inference
Duty U  Inspecting, Repairing, and Maintaining Harden Solder

1. Sharpen drill
2. Silver solder joint
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinding wheel (water cooled)</td>
<td>Dress face of stone</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Drill grinding gage</td>
<td>Readjust tool rest</td>
<td>Disconnect power supply when changing grinding wheels</td>
</tr>
<tr>
<td>Stone dresser</td>
<td>Lip clearance 8° to 12°</td>
<td>Stand to one side when dressing grinding wheel</td>
</tr>
<tr>
<td>Goggles</td>
<td>High speed drill</td>
<td>Never ‘dig’ into the side of a grinding wheel. It will throw wheel out of balance</td>
</tr>
<tr>
<td></td>
<td>High carbon</td>
<td>Tool rests to be adjusted to 1/8 inch or less from face of stone</td>
</tr>
<tr>
<td></td>
<td>Carbide tip</td>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Report all injuries]</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine if the drill is dull

**CUES**
- Length and angle of tips
- Dull cutting edge

**ERRORS**
- No lubricant and/or coolant
- Drill failure
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of friction on work processes and product quality</td>
<td>Index drill calibration</td>
</tr>
<tr>
<td>Arrangement of molecules, atoms and ions and the effect on</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>structure and strength of materials</td>
<td></td>
</tr>
<tr>
<td>Motion resulting from two or more forces acting on a point</td>
<td></td>
</tr>
<tr>
<td>in a body [motion]</td>
<td></td>
</tr>
<tr>
<td>Composition of stone</td>
<td></td>
</tr>
<tr>
<td>Use of coolant to absorb heat during grinding</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE MODES</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Emory cloth</td>
</tr>
<tr>
<td>Silver solder</td>
</tr>
<tr>
<td>Flux</td>
</tr>
<tr>
<td>Oxy-acetylene torch</td>
</tr>
<tr>
<td>Goggles</td>
</tr>
<tr>
<td>Flint lighter</td>
</tr>
<tr>
<td>File</td>
</tr>
<tr>
<td>Deburrer</td>
</tr>
<tr>
<td>Copper tubing</td>
</tr>
<tr>
<td>Copper elbow</td>
</tr>
<tr>
<td>Pliers</td>
</tr>
<tr>
<td>Hack saw</td>
</tr>
<tr>
<td>Fire extinguisher</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean surface</td>
</tr>
<tr>
<td>Check silver content of solder</td>
</tr>
<tr>
<td>Identify correct flux</td>
</tr>
<tr>
<td>Adjust proper flame on torch</td>
</tr>
<tr>
<td>Melting point of solder</td>
</tr>
<tr>
<td>Melting point of copper</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses</td>
</tr>
<tr>
<td>Goggles</td>
</tr>
<tr>
<td>Gloves</td>
</tr>
<tr>
<td>Report all injuries to your foreman</td>
</tr>
<tr>
<td>Check fire extinguisher</td>
</tr>
<tr>
<td>Dispose of scrap material in scrap hopper</td>
</tr>
<tr>
<td>All files must have handles</td>
</tr>
<tr>
<td>Check for flammable material</td>
</tr>
<tr>
<td>Never use cigarette or match to light torch</td>
</tr>
<tr>
<td>Relieve pressure on pipe before starting job</td>
</tr>
<tr>
<td>Empty pipe completely before soldering</td>
</tr>
<tr>
<td>[Smoking not permitted where flammable liquids and paint are being used/stored or posted]</td>
</tr>
<tr>
<td>[Report all injuries]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine whether to use silver solder or soft solder</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration factor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld does not hold</td>
</tr>
</tbody>
</table>
### Task Statement: Silver Solder Joint

<table>
<thead>
<tr>
<th><strong>Science</strong></th>
<th><strong>Math - Number Systems</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects of heating and cooling on expansion of material</td>
<td>Measures of length, OD and ID</td>
</tr>
<tr>
<td>Transfer of heat from one body to another</td>
<td></td>
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<tr>
<td>Arrangement of molecules, atoms, ions and the effect on</td>
<td></td>
</tr>
<tr>
<td>structure and strength of materials</td>
<td></td>
</tr>
<tr>
<td>Theory of attraction of unlike metals</td>
<td></td>
</tr>
<tr>
<td>Cohesion</td>
<td></td>
</tr>
<tr>
<td>Adhesion</td>
<td></td>
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<thead>
<tr>
<th><strong>Communications</strong></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance Modes</strong></td>
<td>Comprehension, detail/inference, trade terminology</td>
</tr>
<tr>
<td>Reading</td>
<td>Description of mechanism, definition, instruction</td>
</tr>
<tr>
<td>Writing</td>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
<tr>
<td>Repair service order</td>
<td></td>
</tr>
<tr>
<td>Parts and repair manual</td>
<td></td>
</tr>
<tr>
<td>Requisition for parts</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
</tr>
</tbody>
</table>
Duty V  Inspecting, Repairing, and Maintaining Bending Pipe

1. Wrinkle bend pipe to 90°
**TASK STATEMENT** WIRKLE BEND PIPE TO 90°

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>Layout</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Oxy-acetylene torch</td>
<td>Adjust torch</td>
<td>Goggles</td>
</tr>
<tr>
<td>Goggles</td>
<td>Observe critical</td>
<td>Burns and</td>
</tr>
<tr>
<td>Flint lighter</td>
<td>temperature</td>
<td>radiation</td>
</tr>
<tr>
<td>Rule</td>
<td>Apply bending force</td>
<td>Gloves</td>
</tr>
<tr>
<td>Soap stone</td>
<td>Time heat belts</td>
<td>Fire extinguisher</td>
</tr>
<tr>
<td>Large vise</td>
<td>Check for accuracy</td>
<td>Check area for</td>
</tr>
<tr>
<td>Chalk line</td>
<td></td>
<td>flammable material</td>
</tr>
<tr>
<td>Framing square</td>
<td></td>
<td>Never use</td>
</tr>
<tr>
<td>Fire extinguisher</td>
<td></td>
<td>cigarette or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>match to light</td>
</tr>
<tr>
<td></td>
<td></td>
<td>torch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Smoking not</td>
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<tr>
<td></td>
<td></td>
<td>permitted where</td>
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<tr>
<td></td>
<td></td>
<td>flammable liquids</td>
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<tr>
<td></td>
<td></td>
<td>and paint are</td>
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<tr>
<td></td>
<td></td>
<td>being used/</td>
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<tr>
<td></td>
<td></td>
<td>stored or posted</td>
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<tr>
<td></td>
<td></td>
<td>[Report all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>injuries]</td>
</tr>
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</table>

**DECISIONS**
- Determine size of pipe
- Determine radius size

**CUES**
- Type of machinery

**ERRORS**
- Inaccurate measurement
<table>
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<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
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<tbody>
<tr>
<td>Effects of heating and cooling on expansion of material</td>
<td>Measure of length [measurements]</td>
</tr>
<tr>
<td>Resistance of materials to change in shape [bending]</td>
<td>Use of arcs or chord in determining facts about a circle</td>
</tr>
<tr>
<td>Melting point of liquid oxygen</td>
<td>or its parts</td>
</tr>
<tr>
<td>Acetone</td>
<td>Determination of facts involving sectors of a circle</td>
</tr>
<tr>
<td>Conditions of metals-stages: Alpha, Beta, Gamma and Delta</td>
<td>Determination of facts involving lines tangent to circles</td>
</tr>
<tr>
<td>Composition of metals</td>
<td>Operating dimensions</td>
</tr>
<tr>
<td>Effects of heat on metals</td>
<td></td>
</tr>
<tr>
<td>Hardening or annealing</td>
<td></td>
</tr>
<tr>
<td>Elongation and/or expansion of metals per degree of heat</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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</tr>
<tr>
<td>Viewing</td>
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<table>
<thead>
<tr>
<th>EXAMPLES</th>
</tr>
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<tbody>
<tr>
<td>Repair service order</td>
</tr>
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<td>Parts and repair manual</td>
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<tr>
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</tr>
<tr>
<td>Penmanship, spelling, classification, terminology</td>
</tr>
<tr>
<td>Visual analysis, describing, logic, detail/inference</td>
</tr>
</tbody>
</table>
INDEX 1

INDUSTRIAL MECHANICS RESPONSIBILITIES

1. wear eye protection
2. arrive promptly on service call
3. contact operator, have machine shut off and secured
4. have operator explain problem as seen
5. before attempting work - pull master switch off and secure switch
6. attempt to ascertain repairs required
7. lay plan of action
8. make repairs
9. reverse proceedings 3 and 5
10. have operator accept as OK
11. return to maintenance for new assignment
INDEX 2
FREQUENCY OF SOME PREVENTATIVE MAINTENANCE PROCEDURES

1. adjust belts, clean and inspect --- 1/2 year
2. check feed screws and adjust as required --- 1 year
3. adjust auto lubers --- 1 year
4. check sight glass oil levers (operator) --- daily
5. lube non-shielded motor ball bearings --- 1/2 year
6. check vibration amplitude all electric motors --- 1 year
7. adjust gibs and examine all machines except the gibs on grinders --- 1/2 year
8. adjust gibs and examine on grinders --- 1/2 year
9. deburr machine ways --- 1 year
INDEX 3
EMPLOYEES PERSONAL TOOLS

1 crescent wrench 6 inch
1 crescent wrench 10 inch
1 crescent wrench 3 inch
1 small proxlyn hammer 10 inch handle
1 standard small ball peen hammer 10 inch handle
1 standard medium ball peen hammer 14 inch handle
1 standard set ¼ inch drive English socket wrenches
1 standard set ½ inch drive English socket wrenches
4 standard set pin punches
4 standard set center punches
4 standard set steel cut chisels
6 standard set screwdrivers
1 standard adjustable hack saw
1 set open end wrenches to 1 inch
1 set box end wrenches to 1 inch
1 standard small pliers
1 standard medium pliers
1 standard large pliers
2 channel lock pliers 6½ inch-9½ inch
1 standard scriber
1 standard combination square (Starret or equivalent)
1 standard 0-1 inch outside micrometer (Starret or equivalent)
1 standard 1-2 inch outside micrometer (Starret or equivalent)
1 standard 0-3 inch depth micrometer (Starret or equivalent)
1 standard good pocket knife
1 standard set phillips drive screwdrivers
1 standard needle nose pliers small
1 standard needle nose pliers medium
INDEX 3 (CON’T)

1 set socket head wrenches to \( \frac{3}{4} \) inch (Allen type)
1 persuader \( \frac{1}{2} \) inch galvanized pipe 10 inch long
1 pair 6\( \frac{1}{2} \) inch vise grips
1 pair 9\( \frac{1}{2} \) inch vise grips
1 outside caliper 4 inch
1 inside caliper 4 inch
1 divider caliper 4 inch
1 rubber mallet
1 scale 6 inch
1 burring tool
1 set jewelers screwdrivers
1 magnifying glass 3 inch
1 safety 2 cell flashlight
1 pipe wrench 10 inch
1 ice pick in sheath
3 pencils
1 tablet
1 dental type mirror
1 machine hand book latest edition
1 drill and tap size chart
1 straight edge \( \frac{1}{4} \times 1 \times 24 \) inches
1 straight edge \( \frac{1}{4} \times 2 \times 48 \) inches
1 small tool box
1 large tool box