Michelin North America

Industrial Maintenance Technical Interview Outline
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The Technical Interview consists of the following components:

- **Aptitude Battery** *(no calculators allowed)*
- **Electrical, Mechanical** or **Multi Skill Test** *(calculators allowed)*
- recommendation for a Personnel Interview *(application required)*

The 1st step in the process is the Aptitude battery (see outline). The aptitude testing session is conducted in a mass screening atmosphere, normally in a lecture, class or conference room. A presentation precedes the testing to inform applicants of our client’s company, benefits, career opportunities, and to answer your questions. A one and one-half (1 ½)-hour block of time is required to conduct a session and feedback is given to each individual. **Successful completion of this step is required in order to proceed to the next step.**

Depending upon the type of job opening that the candidate is applying for, the 2nd step will consist of either a Mechanical, Electrical or Multi Skill Test. Either test has a two (2) hour maximum time limit. The results will be reviewed with the candidate upon completion. **Successful completion of this step is required in order to proceed to the next step.**

Upon successful completion of Step #1 and Step #2, the candidate will be referred for a Personnel Interview. Usually, this interview will be scheduled with the company within 5-10 business days. Occasionally, it could be completed on the same day as the Technical Interview.

**Other Notes:**

- Confirm a testing session *(see invitation letter/email)*
- Bring a calculator
- Bring a completed application (go to [www.centecinc.com/application.pdf](http://www.centecinc.com/application.pdf) to download an application from our website)
- Go to our resources page [www.centecinc.com](http://www.centecinc.com) to obtain study information for the skills assessments from our website
Outline of the Aptitude Test Battery

*** CALCULATORS NOT ALLOWED ***

Test #1: Applied Math Skills (20 minutes long)

- Ability to apply math skills to practical applications of everyday life
- Ability to add, subtract, multiply and divide
- Ability to function with whole numbers, decimals and fractions

Examples:

(A) What is the total weight of four kegs of nails if each keg weighs 100 pounds?

(B) There are 8 gallons of water in a tank which can hold 16.5 gallons. How many gallons can be added to this tank?

(C) How many feet are there in 100 inches?

Test #2: Mechanical Comprehension (30 minutes long)

- Ability to analyze pictures and determine elements and principles of mechanical concepts.

Look at Sample X and Y on this page. It shows two men carrying a weighted object on a plank, and it asks, “Which man carries more weight?” Because the object is closer to man B than to man A, man B is shouldering more weight.

X
Which man carries more weight?
(If equal, mark C.)

Y
Which letter shows the seat where a passenger will get the smoothest ride?
Michelin North America, Greenville SC

**Electrical New Hire Assessment**

**Assessment Topic Percentages**

- **ADMINISTRATION**: 5 questions, 5%
- **AUTOMATION TECHNOLOGY**: 8 questions, 8%
- **ELECTRICAL CONTROL TECHNOLOGY**: 50 questions, 50%
- **ELECTRONICS TECHNOLOGY**: 20 questions, 20%
- **MECHANICAL TECHNOLOGY**: 10 questions, 10%
- **PROCESS CONTROL TECHNOLOGY**: 7 questions, 7%

**Number of Questions:** 100

**Number of Task Statements Assessed:** 44

<table>
<thead>
<tr>
<th>Major Topic</th>
<th># of Questions</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>ADMINISTRATION</td>
<td>5</td>
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<tr>
<td>AUTOMATION TECHNOLOGY</td>
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<td>8%</td>
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<tr>
<td>ELECTRICAL CONTROL TECHNOLOGY</td>
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<td>50%</td>
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<tr>
<td>ELECTRONICS TECHNOLOGY</td>
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<td>20%</td>
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<tr>
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<td>10%</td>
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<tr>
<td>PROCESS CONTROL TECHNOLOGY</td>
<td>7</td>
<td>7%</td>
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</tbody>
</table>
Knowledge and Skill Assessment Task Statements

5%  ADMINISTRATION

100%  OFFICE COMPUTERS

2  Knowledge of basic PC hardware and functions
3  Knowledge of Microsoft Office software

8%  AUTOMATION TECHNOLOGY

100%  INTRODUCTION TO PLC

1  Knowledge of PLC concepts (ladder diagrams, flow diagrams, etc...)
3  Knowledge of PLC concepts (number systems, memory, addressing, processor scan, etc...)
4  Knowledge of PLC hardware fundamentals (Discrete Input and Output modules)
**AC MOTORS**

14%  
1. Able to change direction of rotation of a three phase motor  
1. Able to troubleshoot motors (opens, grounds, and shorts)  
1. Knowledge of AC motor operation (squirrel cage, wound rotor, etc...)  
2. Knowledge of nameplate data  
2. Knowledge of wiring configurations

**AC THEORY**

16%  
2. Able to calculate AC voltages and currents (effective, average, and peak)  
1. Able to calculate Inductive/Capacitive Reactance and Impedance  
1. Knowledge of AC voltage and current (effective, average, and peak)  
1. Knowledge of Inductive/Capacitive Reactance and Impedance  
3. Knowledge of phase relationships between voltage, current and power (Inductive, Capacitive, and Resistive circuits)

**ACTUATORS AND SENSORS**

6%  
3. Knowledge of operation of proximity sensors

**BREAKERS AND FUSES**

6%  
3. Knowledge of fuse and breaker types and ratings

**DC THEORY**

12%  
6. Able to apply Ohm's law to solve problems in series and parallel resistor circuits

**POWER AND CONTROL DEVICES**

10%  
1. Able to determine faulty relays or contactors  
2. Knowledge of control relay operation  
1. Knowledge of solenoid operation  
1. Knowledge of timer operations

**THREE PHASE THEORY**

10%  
4. Able to calculate line and phase voltages and currents  
1. Knowledge of 3 phase AC

**TRANSFORMERS**

6%  
1. Knowledge of nameplate data and ratings  
2. Knowledge of single phase transformer theory

**TROUBLESHOOT POWER AND CONTROL CIRCUITS**

20%  
3. Able to troubleshoot relay control circuits  
3. Able to troubleshoot single and three phase power circuits  
4. Knowledge of analyzing machine sequence from a schematic diagram
20%  ELECTRONICS TECHNOLOGY

15%  AC DRIVE CONTROLLERS
    3  Knowledge of the Volts/Hz curve.

20%  COMPONENTS
    3  Able to identify standard symbols for electronic devices
    1  Knowledge of test procedures for SCRs, diodes, resistors, capacitors, transistors, etc

15%  DC DRIVE CONTROLLERS
    3  Knowledge of the DC Drive Interface circuits.

20%  DC MOTORS
    3  Knowledge of basic DC motor theory
    1  Knowledge of DC motor types, wiring configurations and applications

20%  MOTION CONTROL SYSTEMS
    4  Knowledge of Tachometer, Incremental Encoder, Absolute Encoder and Resolver feedback devices.

10%  POWER SUPPLIES
    2  Knowledge of half wave and full wave bridge rectifiers

10%  MECHANICAL TECHNOLOGY

40%  DRIVE SYSTEMS
    4  Able to determine direction of rotation in a drive system

10%  FASTENERS
    1  Knowledge of standard and metric fasteners

30%  LEVERS
    3  Knowledge of force, distance and fulcrum

20%  SHOP PROJECTS
    2  Able to apply math to shop projects

7%   PROCESS CONTROL TECHNOLOGY

86%  ELECTRONIC CONTROLS
    2  Knowledge of transducers and transmitters
    4  Knowledge of tuning component terminology and applications (P, I, D)

14%  ELECTRONIC FEEDBACK DEVICES
    1  Knowledge of different types of thermocouples
Electrical Written Test Examples

In the figure below, what is the total current of the circuit?

A. 1.2 mA  
B. 2.4 mA  
C. 3.0 mA  
D. 10.7 mA

To prevent a voltmeter from loading the circuit being measured, the

A. meter impedance should be low  
B. ohms per volt should be high  
C. sensitivity should be low  
D. circuit impedance should be high

Identify (if any) the logic traps that appear in the PLC ladder logic below.

A. always on  
B. no trap, rung okay  
C. no way to turn rung off once true  
D. always off

The total resistance of the above circuit is ____ ohms.

A. 50  
B. 100  
C. 150  
D. 200
Mechanical Prehire Assessment

Assessment Topic Percentages

Number of Questions: 100
Number of Task Statements Assessed: 32

<table>
<thead>
<tr>
<th>Major Topic</th>
<th># of Questions</th>
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<td>ADMINISTRATION</td>
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<tr>
<td>HYDRAULIC SYSTEMS</td>
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<td>MECHANICAL TECHNOLOGY</td>
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<tr>
<td>PNEUMATIC SYSTEMS</td>
<td>4</td>
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Knowledge and Skill Assessment Task Statements

4%  ADMINISTRATION

100%  OFFICE COMPUTERS

4  Knowledge of Microsoft Office software

3%  HYDRAULIC SYSTEMS

100%  FLUID THEORY

1  Knowledge of the relationship between pressure, force, and area

2  Knowledge of the relationship between pressure, volume, and temperature
### MECHANICAL TECHNOLOGY

**25% BEARINGS**
- 4 Ability to clean, store, handle and lubricate bearings
- 1 Ability to install and remove various types of bearings
- 2 Ability to recognize bearing types
- 1 Knowledge of bearing failures
- 7 Knowledge of bearing installation techniques
- 7 Knowledge of plain and anti-friction bearings

**17% DRIVE SYSTEMS**
- 5 Ability to determine direction of rotation in a drive system
- 1 Ability to recognize gear types
- 1 Ability to use chain breakers
- 3 Knowledge of coupling types
- 1 Knowledge of gear types
- 1 Knowledge of the type of belt drives
- 3 Knowledge of types of chain drives

**8% FASTENERS**
- 3 Knowledge of proper torquing procedures
- 4 Knowledge of standard and metric fasteners

**2% FITS AND TOLERANCES**
- 1 Knowledge of dimensional alignments and tolerances
- 1 Knowledge of types of fits

**2% LEVERS**
- 2 Knowledge of force, distance and fulcrum

**4% LUBRICATION**
- 4 Knowledge of the properties of lubricants

**10% MEASUREMENT**
- 1 Able to accurately lay out parts for fabrication
- 1 Able to measure accurately to 0.001 inch or 0.02 millimeters
- 7 Able to use calipers, micrometers, height gauges, feeler gauges, dial indicators, and squares

**20% PRINT READING**
- 9 Able to determine the function of an assembly from a drawing
- 1 Able to identify common components and their symbols
- 7 Able to use drawings to assemble/disassemble equipment
- 1 Knowledge of sectional views

**8% SHOP PROJECTS**
- 7 Able to apply math to shop projects

**3% TORQUE AND SPEED**
- 3 Knowledge of common units of torque

**4% PNEUMATIC SYSTEMS**

**100% FLUID THEORY**
- 4 Knowledge of pressure, force and area
Which tool would you use to put threads inside a hole?

A. file card  
B. snips  
C. pin punch  
D. tap

Which of the following pulleys turn the same direction as #1?

A. 2 & 4  
B. 2 & 3  
C. 3 & 4  
D. 1 & 2

A correct torquing pattern for the figure below would be

A. 123456  
B. 164235  
C. 341625  
D. 634125
**Multi Skill Assessment**

**Assessment Topic Percentages**

<table>
<thead>
<tr>
<th>Major Topic</th>
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<tbody>
<tr>
<td>ADMINISTRATION</td>
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<td>AUTOMATION TECHNOLOGY</td>
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<td>MECHANICAL TECHNOLOGY</td>
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<tr>
<td>PNEUMATIC SYSTEMS</td>
<td>4</td>
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**Number of Questions: 150**

**Number of Task Statements Assessed: 57**
Knowledge and Skill Assessment Task Statements

3%  ADMINISTRATION

100%  OFFICE COMPUTERS

4  Knowledge of Microsoft Office software

5%  AUTOMATION TECHNOLOGY

100%  INTRODUCTION TO PLC

2  Knowledge of PLC concepts (number systems, memory, addressing, processor scan, etc…)

4  Knowledge of PLC hardware fundamentals (Discrete Input and Output modules)

1  Knowledge of PLC programming fundamentals (relay logic conversion, software, basic instructions, et ...)
11% **AC MOTORS**
1. Able to change direction of rotation of a three phase motor
2. Able to troubleshoot motors (opens, grounds, and shorts)
2. Knowledge of nameplate data
2. Knowledge of wiring configurations

2% **AC THEORY**
1. Able to calculate AC voltages and currents (effective, average, and peak)

15% **ACTUATORS AND SENSORS**
3. Knowledge of common detectors
1. Knowledge of different operator heads and contact configurations
4. Knowledge of operation of proximity sensors

5% **BREAKERS AND FUSES**
3. Knowledge of fuse and breaker types and ratings

15% **DC THEORY**
8. Able to apply Ohm’s law to solve problems in series and parallel resistor circuits

16% **POWER AND CONTROL DEVICES**
1. Able to determine faulty relays or contactors
1. Knowledge of contactor applications
3. Knowledge of control relay operation
1. Knowledge of electrical and mechanical interlocks
2. Knowledge of solenoid operation
1. Knowledge of timer operations

2% **THREE PHASE THEORY**
1. Knowledge of 3 phase AC

5% **TRANSFORMERS**
1. Knowledge of nameplate data and ratings
2. Knowledge of single phase transformer theory

29% **TROUBLESHOOT POWER AND CONTROL CIRCUITS**
1. Able to recognize electrical symbols and components
6. Able to troubleshoot relay control circuits
4. Able to troubleshoot single and three phase power circuits
1. Able to use test equipment
4. Knowledge of analyzing machine sequence from a schematic diagram

7% **ELECTRONICS TECHNOLOGY**

18% **AC DRIVE CONTROLLERS**
2. Knowledge of the Volts/Hz curve.

36% **DC MOTORS**
2. Knowledge of basic DC motor theory
2. Knowledge of DC motor types, wiring configurations and applications

45% **MOTION CONTROL SYSTEMS**
5. Knowledge of Tachometer, Incremental Encoder, Absolute Encoder and Resolver feedback devices.
MECHANICAL TECHNOLOGY

28%  BEARINGS
   4  Able to clean, store, handle and lubricate bearings
   6  Knowledge of bearing installation techniques
   9  Knowledge of plain and anti-friction bearings

25%  DRIVE SYSTEMS
   5  Able to determine direction of rotation in a drive system
   1  Able to recognize gear types
   1  Able to use chain breakers
   2  Knowledge of coupling types
   1  Knowledge of gear types
   4  Knowledge of the type of belt drives
   3  Knowledge of types of chain drives

9%   FASTENERS
   3  Knowledge of proper torquing procedures
   3  Knowledge of standard and metric fasteners

7%   FITS AND TOLERANCES
   2  Knowledge of cumulative tolerances
   2  Knowledge of the effects of temperature on tolerances
   1  Knowledge of types of fits

3%   LEVERS
   2  Knowledge of force, distance and fulcrum

6%   LUBRICATION
   4  Knowledge of the properties of lubricants

12%  MEASUREMENT
   1  Able to accurately lay out parts for fabrication
   2  Able to measure accurately to 0.001 inch or 0.02 millimeters
   5  Able to use calipers, micrometers, height gauges, feeler gauges, dial indicators, and squares

3%   PRINT READING
   1  Able to identify common components and their symbols
   1  Knowledge of sectional views

6%   SHOP PROJECTS
   4  Able to apply math to shop projects

3%   TORQUE AND SPEED
   2  Knowledge of common units of torque

3%   PNEUMATIC SYSTEMS

100%  FLUID THEORY
   4  Knowledge of pressure, force and area
Multi Skill Written Test Examples

In the figure below, what is the total current of the circuit?

![Circuit Diagram]

E. 1.2 mA  
F. 2.4 mA  
G. 3.0 mA  
H. 10.7 mA

To prevent a voltmeter from loading the circuit being measured, the

E. meter impedance should be low  
F. ohms per volt should be high  
G. sensitivity should be low  
H. circuit impedance should be high

Which tool would you use to put threads inside a hole?

E. file card  
F. snips  
G. pin punch  
H. tap

A correct torquing pattern for the figure below would be

![Pattern Diagram]

E. 123456  
F. 164235  
G. 341625  
H. 634125