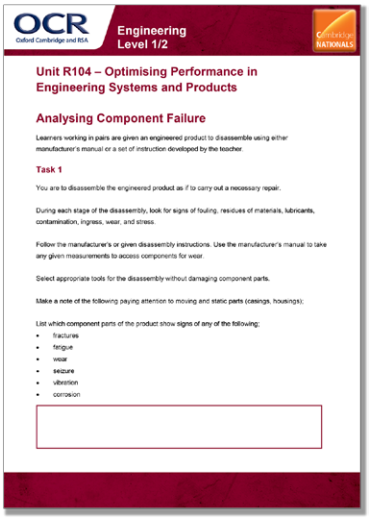
Unit R104 – Optimising Performance in Engineering Systems and Products

Analysing component failure

Instructions and answers for teachers

*These instructions should accompany the OCR resource **'Analysing component failure'** activity which supports OCR Cambridge Nationals in Engineering.*


OCR Engineering Level 1/2

Unit R104 – Optimising Performance in Engineering Systems and Products

Analysing Component Failure

Learners working in pairs are given an engineered product to disassemble using either manufacturer's manual or a set of instruction developed by the teacher.

Task 1

You are to disassemble the engineered product as if to carry out a necessary repair.

During each stage of the disassembly, look for signs of fouling, residues of materials, lubricants, contamination, ingress, wear, and stress.

Follow the manufacturer's or given disassembly instructions. Use the manufacturer's manual to take any given measurements to access components for wear.

Select appropriate tools for the disassembly without damaging component parts.

Make a note of the following paying attention to moving and static parts (casings, housings):

List which component parts of the product show signs of any of the following:

- fractures
- fatigue
- wear
- seizure
- vibration
- corrosion

The Activity:

This resource comprises of 2 tasks. The activities are best completed either in pairs or small groups. Learners may need to use online resources to research material uses or check their understanding to complete the activity.

This activity offers an opportunity for English skills development.

Associated materials:

'Analysing Component Failure' learner activity sheet

Suggested timings:

Tasks 1 and 2: 1.5 hours

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Task 1

You are to disassemble the engineered product as if to carry out a necessary repair.

During each stage of the disassembly, look for signs of fouling, residues of materials, lubricants, contamination, ingress, wear, and stress.

Follow the manufacturer's disassembly instructions. Use the manufacturer's manual to take any given measurements to assess components for wear.

Select appropriate tools for the disassembly without damaging component parts.

Make a note of the following, paying attention to moving and static parts (casings, housings);

List which component parts of the product show signs of any of the following:

- fractures
- fatigue
- wear
- seizure
- vibration
- corrosion

List which parts require lubrication or cooling in operating conditions.

Example

Learners disassemble a typical 240V hammer drill using manufacturer's exploded diagram to show assembly methods and fixings.

Learners select appropriate tools including torx driver, long/pin nose pliers, posi drive screw driver.

- Outer casing. Sign of usage in a range of normal operating conditions with some signs of fatigue, but no cracks or substantial damage.
- Electrical cable strain relief not intact.
- Motor Brushes worn to excess.
- Hammer selector cam shows signs of wear through vibration.

Parts requiring lubrication.

- Gearbox.
- Hammer selector cam.
- Chuck end open bearing.

Task 2

Using your observations and measurements, suggest the likely causes for the conditions leading to component wear of failure. You may want to use a table to present your findings.

Example

Learners develop a table of their findings and recommended actions.

Component/ assembly	Condition, wear, damage etc	Cause	Repair/Action required
Outer casing	Signs of usage in a range of normal operating conditions with some signs of stress shown as a whitening of ABS casing, but no cracks or substantial damage. Some grease collected inside case from gearbox and other matter/ dust.	Normal usage and some signs of the drill being dropped.	Clear inner casing of residue or lubricants and other matter.
Electrical cable and plug	Cable pulled through strain relief clamp and rubber boot stretched and split.	Normal wear in-service wear and cable being pull/stretched beyond reach in use.	Replace rubber boot if available. Secure cable outer insulation in strain relief clamp.
Chuck Assembly	Chuck shows sign of wear on outer sleeve with some dents but functional.	Possible that drill has been dropped or has had an impact on the outer sleeve of the chuck by the operator due to partial sticking/seizure.	Clean chuck and lubricate liberally with WD40 or similar freeing agent.

Component/ assembly	Condition, wear, damage etc	Cause	Repair/Action required
Gearbox	Gearbox lubrication has solidified and this has resulted in early signs of wear on the gears. Some contamination with materials as a result of drilling, which appears to have entered through ventilation facility in the casing.	Prolonged use without maintenance.	Clean gears and lubricate with recommended lubricant.
Commutator and brushes	Motor brushes worn below minimum length of 12mm. Commutator requires light cleaning but is not pitted or burnt.	Normal wear.	Replace brush set and lightly clean commutator with very fine grade wet and dry.
Bearings	Some play in commutator end (sealed) bearing. Bearing is dry. Chuck end open bearing requires cleaning and lubrication.	Normal wear.	Replace sealed commutator end bearing. Lubricate chuck end bearing.
Hammer selector cam	Signs of wear through vibration but still functional.	Vibration through normal use.	Lightly lubricate.

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