

Four-Stroke Engine: Emission System

-Student Notes

Directions:

Fill in the blanks.

Regulations Segment

1. Emission Systems

- Keep the engine running cleanly and _____ in various operating conditions
- Control the emissions, exhaust and pollutants in order to reduce harmful _____

2. Emission Standards

- Are enforced to _____ the _____ of harmful gases from the engine and other components

3. Federal Clean Air Act

- Was passed in _____
- Has a goal to reduce the harmful atmospheric pollution caused by internal combustion engines and other sources
 - initially, the problem of _____ pollution caused by engine emissions was focused on car and truck engines

Four-Stroke Fact: in 1990, the state of California was the first to focus attention on emissions caused by the large number of small engines used in lawn and garden equipment, by passing the first emission standards for these engines.

4. Clean Air Act Standards

- Took effect for engines built in the _____ model year
 - in 1995, the U.S. Environmental Protection Agency (EPA) adopted updated _____ to continue to reduce emissions produced from these engines

5. Phase 1 Standards

- Were adopted in 1995 for small _____ engines
- Targeted non-road, spark-ignited engines with a gross output at or below _____
- Included a goal to reduce emissions of hydrocarbons and oxides of nitrogen by approximately 32 percent

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6. Phase 1 Standards

- Include five _____ classes which set limits for emissions for small engines
 - these displacement classes fall under _____ equipment types
 - non-handheld
 - Handheld

7. Non-Handheld Equipment

- Uses mostly _____ engines
- Has _____ displacement classes
 - class 1
 - 0 – 225 cc
 - class 2
 - 225 cc and above

8. Handheld Equipment

- Uses mostly _____ engines
- Has three displacement classes
 - class 3
 - 0 – 20 cc
 - class 4
 - _____
 - class 5
 - 50 cc and above

9. Phase 2 Standards

- Were adopted in 2000 for small spark-ignition engines
- Were phased in between the _____ model years
- Included a goal to reduce emissions of _____ and oxides of nitrogen by 70 percent over Phase 1 standards

10. Non-Handheld Equipment

- Gained two new classifications as a result of _____ standards
 - class 1A
 - engines with displacement 66 cc and under
 - class 1B
 - engines with displacement between _____

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11. Phase 2 Standards

- Require a program of _____, assembly line testing and in-use testing for _____ to certify they meet emission requirements

Four-Stroke Fact: This phase includes all engines manufactured to be in compliance with Phase 2 standards, as well as any engine assembled in the future.

12. Phase 3 Standards

- Were adopted in April 2007 for new non-road spark-ignition engines, _____ and vessels
- Were completely _____ in by the 2012 model year
- Reduced emissions over the Phase 2 standards by 30 to 40 percent

13. Phase 3 Standards

- Included a goal to further reduce emissions of oxides of _____, hydrocarbons and carbon monoxides from small (25 hp and under) spark-ignition engines, marine outboard engines and personal watercraft engines
- Included regulations to limit emissions due to _____, leakage and fuel system venting

14. Emission Regulations

- Can be viewed by visiting _____

Maintenance & Warranty Segment

1. Servicing Emission-Controlled Engines

- Depend on the engine size and the year the engine was manufactured
 - each certified engine will carry a label indicating the level of emission compliance and help the service _____ identify the regulations which apply to the particular engine
 - labels are affixed directly to the engine, or if the label obscures during _____, the label may be placed on the equipment itself

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2. Servicing Emission-Controlled Engines

- Includes following the operator's and service _____
 - equipment owners should only attempt service procedures as outlined in the operator's manual; all other service procedures should be performed by a _____ service technician

Four-Stroke Fact: Any servicing or modifications performed beyond what is documented in the manuals is considered tampering.

3. Engine Parts

- Which are sold by an after-market _____ may be used as long as they conform to the original parts in _____ and function

Four-Stroke Fact: Use of parts which do not conform to the function of the original manufacturer's standards qualifies as engine tampering and is in violation of the law.

4. Tampering

- Is defined as "adjustment of the fuel or _____ system or changing the engine's performance so that it no longer meets the manufacturer's _____"

5. Tampering

- May be prevented by equipping an engine with _____ or plugs which prevent or limit adjustments
 - removal of these caps and/or plugs and _____ of engine systems are considered tampering

Four-Stroke Fact: Newer engines may not allow adjustments.

6. Tampering

- Should be recorded by technicians before performing any work
 - _____ regulations do not require technicians to restore an engine which has been tampered with, unless the required _____ is to the tampered system
 - in such cases, the technician must restore the system to its original state

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7. Tampering

- Has serious consequences
 - any technician and/or repair _____ which completes, assists or participates in any way to the tampering of an emissions-certified engine is liable for a _____ of up to \$37,500 per tampering act per engine

8. Tampering

- Includes:
 - removal of any element of the emissions control system
 - rendering the emissions controls _____
 - replacing an element of the emissions control system with a non-similar replacement part
 - failure to install the limiter caps after carburetor service
 - mis-fueling or using incorrect _____, leading to damage of the emissions control system
 - making, selling or installing emissions-defeating devices

9. Emission-Related Parts

- Are required by federal law to be covered by _____ for the first two years of engine use
- Covered by warranty include:
 - any part whose primary purpose is to control emissions, such as a catalytic converter
 - any part which has an effect on emissions, such as a _____

10. Warranty Claims

- Are established by _____
 - the engine owner or technician should contact the person identified to address warranty claims by the manufacturer in the _____ and/or service manual