ILEVE

Institute of Local Exhaust Ventilation Engineers

Best Practice Guide to Commissioning of LEV Systems.

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Purpose:

This document is to be used as a best practice guide for the commissioning of local exhaust ventilation systems.

It is to be used by local exhaust ventilation (LEV) commissioning engineers.

It may also be helpful to system owners and duty holders in checking that commissioning has been carried out in accordance with statutory requirements and industry best practice.

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Contents:

1 Introduction

The Control of Substances Hazardous to Health (COSHH) Regulations state that every employer has a duty to ensure that exposure of his employees to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled {COSHH Regulation 7(1)}.

The overriding objective of a Local Exhaust Ventilation (LEV) system is to adequately control exposure to substances hazardous to health. Commissioning is proving that a LEV system is capable of providing adequate control. It is the act of testing and adjusting to achieve an agreed performance criterion; proving that the LEV system is capable of adequately controlling emissions generated by the work activity or process. The measured performance criterion becomes the benchmark for subsequent statutory thorough examination and tests.

Often referred to as 'initial assessment' or 'intended operating performance', commissioning should be undertaken when LEV systems are installed or substantially modified.

In reality, suitable and sufficient commissioning of LEV systems is rarely carried out. Consequently, performance criterion cannot always be relied upon as a measure of adequate control of exposure to the emissions generated by the specified process.

An LEV commissioning should

(i) decide whether operator exposure to substances hazardous to health generated by the process is adequately controlled or not;

(ii) for pre-existing systems act as a retro-commissioning document (refer to Health and Safety Executive's document 'Controlling airborne contaminants at work' HSG 258 – para 335).

Therefore, the aim of the commissioning is to carry out a series of visual appraisals and measurements to gather relevant information, which allows the examiner to make a sound judgement on the efficacy of the system (i.e. to determine if the control measure is providing adequate control of exposure to the substances hazardous to health that are being used, generated or emitted by the task or process being studied).

The key features to look for in a commissioning LEV report are

- identification of the hazardous substance and /or the appropriate control WEL ("workplace exposure limit") or OEL ("occupational exposure limit")
- that the LEV matches the quoted specification (if available) indicating that it has been correctly installed
- should be able to show it is being used correctly
- demonstrates if adequately controlling contaminant clouds i.e. indication that the LEV controls exposure to the hazardous substance to below the WEL/OEL and/or achieves ALARP etc.
- a facility to highlight any modifications needed to improve control
- Identifies the benchmarks for comparison during routine thorough examination and tests (TExT's).
- identify appropriate maintenance program for the routine checks that the operators should be performing and recording

- Where appropriate calibration parameters for the airflow indicators or other alarms which should be fitted and calibrated during commissioning
- noise level readings for the air mover or other parts of the LEV system

This list is not exhaustive but is a sample of the main points that should be included in the Commissioning document. Various processes will require more information or additional tests to be carried out and advice on this should be sort in the appropriate

documentation. Commissioning reports should include the details as listed in COSHH ACOP and HSG258 (see reference list for assistance).

All of this should enable an appropriate maintenance logbook to be created for continuous monitoring of the system effectiveness.

Ideally commissioning of an LEV system should be carried out after all works / installation has been completed. Any snagging is completed and post-installation checklist are completed by the mechanical installation contractor. Operators should have been given the O&M manual and some initial training so that a standard working environment can be replicated as the report needs to comment on the operator's use of the system. Where some particulate filters are present it is recommended to delay final commissioning for a short period to allow the filters to develop the 'dust cake', where applicable. This is not necessary for systems without particulate filters.

Where there is no existing commissioning report proving the effectiveness of the LEV, it can be extremely challenging to carry out the routine TExT's properly. As the purpose of the TExT is to confirm that the LEV is still effective by comparing performance parameters with those taken at commissioning. The lack of this initial benchmark report may invalidate any subsequent TExT. Likewise, if a comprehensive LEV commissioning report has not previously been carried out or, the contents do not prove that control is effective, the owner of the LEV should arrange for an experienced LEV Commissioning Engineer to commission retrospectively. By carrying out Retrospective Commissioning, this will establish performance parameters at which the level of control is effective so that there is a set of results to compare with each future annual TExT.

2 Information and documentation required for commissioning

To be able to undertake commissioning the LEV commissioning engineer will require the following information provided by the system owner / duty holder:

- Design specification including:
  - Description of process & source of contaminant
  - Details of the hazardous substances to be controlled (Safety Data Sheets)
  - Workplace Exposure Level and level of control to be achieved (agreed benchmark)
  - Filtration (if fitted) specification
  - Number of points in operation at any given time (concurrency)
  - DSEAR zoning and report (if applicable)
  - As installed layout drawings and schematics
- Operating and Maintenance manuals for plant installed
- Details on how system will be used in practice i.e. all dampers open (or not) for multi duct system.
- User instructions including set-up guides
- Training requirements
- COSHH Regulation 6 Risk Assessment for the processes to be controlled
- Electrical installation certificate

The above list is not exhaustive and other documentation may be required.

The above information may not be available. In this instance additional works may need to be carried out by the commissioning engineer to obtain the required information.

3 Demonstrating Adequate Control

To be able to determine if adequate control is being achieved, both the process generating the contaminant and the associated controlling LEV system must be fully operational and functioning correctly.

The important information needed to assess the effectiveness of control will be gained by the use of various techniques that include:

Smoke generation is a useful method for initial assessment and demonstrating issues to clients and end users.

Dust Lamp is a simple tool for making fine particles visible (i.e. dusts, fumes, fibres and mists).

Direct Reading Instruments (such as Dust Monitors, Photo-Ionisation Detectors)

The instrument can be used to detect a process generated contaminant:
(i) at the source;
(ii) escaping the system (e.g. leaks, area of influence of the hood etc.);
(iii) entering an operative's breathing zone;
(iv) being emitted in the exhaust air of a recirculating LEV system.

It is not an alternative to personal or static air monitoring.

Monitoring using Sampling Pumps and Collection Media

In some instances, it may not be possible to determine if an LEV system can adequately control exposure, in which case further information may be needed such as static and personal air monitoring data etc.[3]

Static monitoring can be used to determine:
(i) the escape of a specific substance from the area of influence of a hood;
(ii) to indicate the efficacy of filters fitted to a recirculating LEV system;
(iii) if the control solution is able to adequately control the hazardous substance generated by a specific process.

Personal task-based monitoring can be used to:
(i) compare directly to any exposure limits[4];
(ii) determine if it is possible to approach or exceed an exposure limit when the frequency and duration of the task is taken into consideration.

For highly toxic materials (e.g. active pharmaceutical ingredients) it is best practice to use surrogate materials during the commissioning stage.

In conclusion, all the techniques described above have their merits and limitations. Depending on the circumstances of the case (conditions, task, process, level of control needed etc.), the reality is that it will probably require the utilisation of several or all of the techniques to satisfactorily demonstrate adequate control of exposure.

Interpretation

For substances considered to be carcinogenic, mutagenic or sensitising agents, exposure by inhalation must be reduced to as low a level as is reasonably practicable (ALARP). It is considered good practice to reduce exposure to these types of substances to below 1/10th of their respective Workplace Exposure Limits (WEL's).

For a substance of low toxicity and with no meaningful adverse health effects, exposure by inhalation would only need to be reduced to below the exposure limit.

Setting Benchmark Standards

Once adequate control has been demonstrated, the system can be designated as being commissioned for use. The performance parameters needed to achieve adequate control can then be established as the **benchmark standards** by which all other future testing should be compared; i.e. if the processes has not been changed, and the measured performance parameters are the same then by association it should be safe to assume that adequate control is still being achieved.

The benchmark standards can be in various forms such as:

(i) static pressures at specific points in the system;
(ii) volume flow rate at specific points or of the system as a whole;
(iii) control air velocity at sources or across the hood faces;
(iv) air velocities inside the ducting at specific locations.

Only if the system has been maintained in:

- an efficient state,
- efficient working order,
- good repair and
- clean condition,

4 Installation verification

All equipment selected to form the LEV system must be suitable for the process e.g. corrosion / abrasion resistant etc where applicable, it must be fit for purpose and must not in use or at rest, constitute a risk to operators or machinery.

As part of the commissioning process the commissioning engineer is to check that:

- The system has been installed in accordance with the system design and manufacturers recommendations
- It is suitable for the process and substances being handled
- The system is in balance
- It is in accordance with industry best practice (e.g. ducting to BESA standards)
- Electrical installation is sound and safe for use and in line with the current electrical standard. Checks to include:
    - Visual check of installation (cable condition, signs of overheating etc)
    - Earth bonding of ducting and plant
    - Controls, including inverters are installed correctly
- Airflow indication devices & system pressure gauges (hood airflow & filter condition etc.) are present and operational.
- They system complies with DSEAR.

5. User Training

For LEV systems to provide adequate control it is essential that the operator is trained to use the system correctly. COSHH Regulation 8 puts a legal requirement on users to correctly use all control measures provided as intended. Explaining the health effects associated with the hazardous substance and how these are controlled by the correct use of the LEV will encourage operator engagement.

Training should include but is not limited to:

- Information on importance of use
- Processes and Substances to be controlled
- How and when to turn system on/off
- Operator interactions (e.g. adjustment of hoods, working position etc.)
- Limitations of use (e.g. Damper positions etc)
- Alarms and indicators
- Daily system routine checks and maintenance
- Maintenance, such as emptying of collection vessels where fitted
- Consumable items including filter cleaning and changing routine
- Typical failures and problems
- Troubleshooting
- How to record and report problems

6. Statement of Compliance

Upon successful completion of the commissioning process, the commissioning engineer is to make a signed statement as to the effectiveness of the level of control achieved.

In the vast majority of situations effective LEV will achieve adequate control. However, in some instances additional means of control may be required. This should be specified in the report.

The commissioning report is to set out benchmarks which future TEXTs are to be compared against.

7. Statement of concern or non-compliance

Should a system fail the commissioning checks then a report should be issued detailing:

- Why the system fails to meet compliance
- A prioritised list of what remedial actions should be undertaken to bring the system into compliance

Typical failures may include:

- Failure to provide adequate control
- Failure to use the control correctly
- Failure to convey substance through system
- Recirculation or re-entry of hazardous substance
- Failure of plant to meet manufacturer's specification
- Unsafe situations (e.g. electrical installation)
- Non-compliance with DSEAR

For carcinogens and respiratory sensitisers, design parameters may be achieved. However, when all control measures are in place the exposure may not be controlled to As Low As Reasonably Practicable (ALARP). In this case this would be a non-compliance.

This list is not exhaustive.

8. Further Reading

1 HSE HSG258

2 L5 – COSHH ACoP

3 BESA TR40

4 BESA DW144

5 MDHS 82-2 'The Dust Lamp'.

6 BS EN 689:2018 Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values.

9. Glossary of terms

Term	Definition	Comments
Performance criterion	The required benchmarks (i.e flow-rate, pressure etc) necessary for a LEV system to effectively remove airborne contaminants at source	
ACOP	Approved Code of PRactive. This carries greater legal weight in GB courts than 'guidance'.	Check HSE website for status.
Benchmarks	Performance targets, eg flow rate, pressure, degree of exposure.	
Commissioning	Sometimes called Initial Appraisal. It is the proof that an LEV system is capable of providing adequate control.	
Dust cake	The layer of dust that builds up on a fabric filter.	Initially, this improves the filter performance but airflows reduce and filters can clog.
Dust Lamp	A parallel light beam illuminates the dust cloud to produce forwards light scattering.	This enables the assessment of particle cloud size and movement.
Exposure Limit	OEL is the ususal general acronym for occupational exposure limits. Workplace Exposure Limits (GB).	TLV was the earliest OEL type and may still be the most widely used type of OEL's. Most OEL's refere to an 8-hour and 15minute TWA's.