

ISO 23875:2021 + Amendment 1:2022

Clause-by-Clause Citation Table (Exact Quotations + Locations)

Notes on locations: For PDF sources, page numbers refer to the PDF page as displayed in the source document. For some open-access journal articles available only as HTML (PMC), the location is provided as section and line range.

ISO Clause / Topic	ISO Technical Element	Supporting Research (peer-reviewed / NIOSH)	Exact quotation (≤25 words)	Location (page / section)	How it supports the clause
4.1 (Performance)	Filtration + integrity are foundational	Organiscak, Cecala & Hall (NIOSH IC 9531, 2018)	“Two key elements... are a good filtration system and an enclosure with good integrity (sealed isolation...)”	IC 9531, p.63	Directly supports ISO’s performance premise and design basis: filtration + enclosure integrity drive achievable in-cab performance.
4.1 (Performance) / Amd 1	Minimum intake filtration performance	Organiscak, Cecala & Hall (NIOSH IC 9531, 2018)	“A good filtration system should include filtering out at least 95% or greater... from the outside intake air...”	IC 9531, p.63	Provides scientific basis for Amendment 1’s emphasis on submicron efficiency and for ISO performance targets requiring high intake filtration effectiveness.
4.1 (Performance)	Recirculation filtration component	Organiscak, Cecala & Hall (NIOSH IC 9531, 2018)	“...with an additional recirculation filtering component for the inside	IC 9531, p.63	Directly supports ISO requirement for recirculation filtration and the concept of rapid internal

			air.”		cleanup (decay time).
4.2.2.1 (Pressurization system)	Dedicated intake pressurizer (booster fan)	Organiscak, Cecala & Hall (NIOSH IC 9531, 2018)	“A separate intake air pressurizing fan (booster fan) is recommended...”	IC 9531, p.63	Direct support for ISO’s pressurization architecture and continuous filtered intake air design.
4.2.1 (Enclosure integrity)	Integrity enables positive pressure	Cecala et al. (JOEH, 2005) – drill cab exposure reduction paper	“Two critical components... filtration and pressurization... along with... structural cab integrity, which allows the cab to be positively pressurized.”	JOEH paper PDF, p.1	Directly supports ISO’s enclosure integrity requirements as enabling condition for pressurization-based control.
4.2.2.2 (Filtration)	Efficiency + recirculation are dominant factors	Organiscak & Cecala (NIOSH 2009-103)	“largest reductions... achieved with an increase in intake filter efficiency and the use of a recirculation filter.”	NIOSH 2009-103, p.16	Directly supports clause requiring both intake and recirculation filtration and explains why both are required for performance.
4.2.1 / 4.2.3 (Integrity & sealing)	Leakage is significant (bypass/leaks)	Organiscak & Cecala (NIOSH 2009-103)	“It also shows that leakage had a significant effect on cab Pen for both systems.”	NIOSH 2009-103, p.20	Supports ISO requirements to minimize leakage pathways (enclosure + housings) and the rationale for leakage

					testing.
4.2.2.1 (Pressurization)	Pressurizer increases airflow and pressure	Organiscak & Cecala (NIOSH 2009-103)	“Adding an intake pressurizer fan... increased intake airflow and cab pressure significantly...”	NIOSH 2009-103, p.27	Directly supports ISO pressurization requirements and explains system impacts under controlled testing.
4.1 / 4.2.2 (Performance & system architecture)	Protection factor concept and variability	Cecala et al. (SME Preprint 13-011, 2013)	“field studies... results... (protection factor: 3 – 89)...”	SME 13-011, p.1	Supports ISO emphasis on verification testing and consistent performance; shows real-world variability without standardized requirements.
4.3 (Monitoring)	Pressure monitoring indication for problems	Cecala, Noll & Organiscak (2013) – Long-Term Evaluation	“...could provide a visual indication... of a potential problem... it would be of great benefit...”	Long-term evaluation PDF, p.9	Directly supports ISO’s monitoring requirements (pressure monitoring as early warning for performance degradation).
5.1.3 (Verification testing) / 4.3	Particle counting for performance evaluation	Moyer, Heitbrink & Jensen (JOEH, 2005) – Tractor cab integrity	“application of a low-cost, optical particle counter to evaluate... tractor cab	Tractor cab integrity PDF, p.2	Supports ISO test philosophy: objective, repeatable measurement methods for enclosure

			filtration systems.”		filtration performance.
4.2.1 / 6 (Integrity & operation)	Door opening reduces efficiency; sealing matters	Noll et al. (2014) – MERV 16 filters & work practices (PMC)	“reduced by more than 90% when the cabs were properly sealed... when the cab door was opened... reduced to 80%...”	PMC45219 97, lines L109-L110	Direct support for ISO operational requirements (keep openings closed) and integrity as a determinant of performance.
4.3 (Monitoring) / 6 (Operation)	Pressure indicates whether enclosure is open/leaking	Noll et al. (2014) – MERV 16 filters & work practices (PMC)	“...did not exceed 0.4 mg/m ³ unless the pressure was zero, indicating that the door was open.”	PMC45219 97, lines L257-L258	Supports ISO pressure monitoring utility for detecting loss of integrity and correlating to exposure risk.
4.1 (CO ₂) / 4.3 (CO ₂ monitoring)	CO ₂ used to manage adequate ventilation	Noll et al. (2015) – Control room filtration/pressurization (PMC)	“ASHRAE considers 1,000 ppm... (or 1,100 ppm...)... as a guideline to indicate adequate ventilation...”	PMC47309 52, lines L234-L235	Directly supports ISO’s CO ₂ control/monitoring clause as ventilation adequacy indicator (IH/ventilation practice).
4.1 / 4.2.2.1 (Pressure)	Positive pressure minimizes particle entry	Noll et al. (2015) – Control room filtration/pressurization (PMC)	“A positive pressure near 0.02 inches of water gauge... minimizes the entry of particles...”	PMC47309 52, lines L109-L111	Supports ISO positive pressure requirement as a mechanism limiting ingress of contaminants.

5.1.3 (Verification) / 4.3 (Monitoring)	Quantify PF; pressure monitor provides insight	Patts et al. (2018) – Underground crusher booth (PMC)	“highly recommende d that... quantified... Analogous... fit testing... door... seals... filter efficiency and leaks...”	PMC62680 07, lines L227-L228	Supports ISO’s verification and monitoring philosophy: quantify PF; performance depends on seals, airflow, efficiency, leaks.
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References (sources cited in table)

- Organiscak JA, Cecala AB, Hall RM. (2018). Design, testing, and modeling of environmental enclosures for controlling worker exposure to airborne contaminants. NIOSH IC 9531.
- Organiscak JA, Cecala AB. (2009). Key Design Factors of Enclosed Cab Dust Filtration Systems. DHHS (NIOSH) Publication No. 2009-103.
- Cecala AB, Organiscak JA, Noll JD, Rider JP. (2013). Key components for an effective filtration and pressurization system to reduce respirable dust in enclosed cabs for the mining industry. SME Preprint 13-011.
- Cecala AB, Organiscak JA, Zimmer JA, Heitbrink WA, et al. (2005). Reducing enclosed cab drill operator’s respirable dust exposure with effective filtration and pressurization techniques. Journal of Occupational and Environmental Hygiene.
- Moyer ES, Heitbrink WA, Jensen PA. (2005). Test for the integrity of environmental tractor cab filtration systems. Journal of Occupational and Environmental Hygiene.
- Cecala AB, Noll JD, Organiscak JA. (2013). Long-term evaluation of cab particulate filtration and pressurization performance.
- Noll JD et al. (2014). Effects of MERV 16 filters and routine work practices on enclosed cabs for reducing respirable dust and DPM exposures in an underground limestone mine. (PMC article).
- Noll JD et al. (2015). Instituting a filtration/pressurization system to reduce dust concentrations in a control room at a mineral processing plant. (PMC article).
- Patts JR et al. (2018). Improving protection against respirable dust at an underground crusher booth. (PMC article).