

Returning workers with mine dust lung diseases to the workplace

Background

Following the re-identification of coal workers' pneumoconiosis (CWP), the Coal Workers' Pneumoconiosis Select Committee was established to conduct an inquiry and report on CWP in coal mine workers in Queensland. A CWP Stakeholder Reference Group was also established consisting of representatives of employers, unions, the legal profession, insurers and government departments relevant to coal mining. This group was to provide advice on any gaps in Queensland's workers' compensation scheme and recommended, amongst other matters, extra rehabilitation support to assist workers back into suitable alternative employment.

Separate concerns were raised by stakeholders about identifying suitable return to work options for workers diagnosed with CWP or other mine dust lung diseases (MDLD), as a key barrier to reintegration to their pre-injury employment. To address these concerns, a working group, including representatives of insurers, employers and workers, carried out further work to facilitate more collaborative, transparent and positive return to work outcomes for workers and provide greater certainty for employers about their return to work obligations.

The working group identified a number of issues impacting on successfully returning workers with a diagnosis back into the workplace. One of the major barriers was uncertainty about dust exposure and ongoing monitoring for these workers. The stakeholder working group agreed to seek advice from an expert medical panel consisting of:

- Dr Robert Cohen, Respiratory Physician and Professor of Medicine; Northwestern University Feinberg School of Medicine and University of Illinois Chicago, School of Public Health
- Dr Robert Edwards, Respiratory Physician, Wesley Dust Disease Research Centre
- Dr Matthew Brandt, Consultant Occupational Physician (FAFOEM-RACP)
- Dr David Cleveland, Occupational and Environmental Physician Registrar, Adjunct Senior Research Fellow, James Cook University, General Practitioner.

Note: these guidelines apply to workers diagnosed with a mine dust lung disease and are not applicable to workers diagnosed with dust lung diseases related to artificial stone fabrication because of the high levels of respirable crystalline silica associated with these processes.

Purpose

These guidelines provide an evidence-based framework for the purposes of sections 220 and 228 of the *Workers' Compensation and Rehabilitation Act 2003* for appropriate, supported, safe return to work for a worker diagnosed with MDLD by a respiratory physician.

This guideline covers:

- the recommended process for carrying out a workplace occupational dust exposure assessment for a worker diagnosed with a MDLD
- requirements for enhanced medical surveillance for a worker with a MDLD
- return to work recommendations for a worker with a MDLD with regard to their disease severity
- adjustments for non-standard work cycles
- psychosocial factors impacting on return to work.

The guidelines are underpinned by the following:

- alignment with the 'Health Benefits of Good Work' statements and documents produced by the Australasian Faculty of Occupational and Environmental Medicine of the Royal Australasian College of Physicians
- acknowledgement that significant work is being undertaken by the mining industry to minimise exposure to mine dust
- acknowledgement of the universal duties of care that employers have to their employees
- acknowledgement of the fundamental roles of key stakeholders in facilitating a best practice injury management pathway for a worker diagnosed with MDLD
- acknowledgement that best practice injury management not only meets statutory obligations, but also takes in to account the complex psychosocial and medical aspects of MDLD
- acknowledgment that despite best intentions and efforts, disease progression may continue in the absence of exposure or in low exposure conditions and so periodic health surveillance is essential.

Workplace occupational dust exposure assessment

In supporting a worker with MDLD to safely return to work, it is recommended that:

- the worker be assigned to a suitable similar exposure group (SEG) known to have exposures below the guideline exposure values.
- a documented workplace inspection and occupational dust exposure assessment be undertaken to assess the full range of tasks being undertaken by a worker in the SEG, in order to identify any site-specific restrictions which should be applied to ensure the individual avoids high exposure tasks/ activities.
- the workplace assessment be conducted by an occupational hygienist (OH) with experience in completing task analyses in the coal mining sector and assessing the effectiveness of controls
- the workplace assessment be informed by baseline personal dust sampling of all inhalable (where relevant) and respirable dust and performed for full shift exposures, which should be below the relevant time weighted average shift adjusted exposure limit for non-standard work cycles.

The proposed exposure guideline values have been derived from epidemiological studies and values recommended to prevent disease onset in 'healthy' workers. They should be viewed as a guideline only due to these inherent limitations. It should also be noted that disease progression may continue in the absence of further exposure or in reduced exposure conditions, so periodic health surveillance is an essential contingency.

Minimising exposure may require a change in duties or additional control measures. Exposure to other respiratory hazards should be controlled to the greatest extent possible. Implementation of control measures should follow the hierarchy of control principles, and may involve isolation/separation, engineering controls, administrative and work practice controls.

The work areas and controls should be site / task specific and should be determined taking into account the initial site-based inspection and other information provided by supervisors, worker's representatives, occupational hygienist and occupational physician; in particular these work areas and duties must exclude areas designated as mandatory respiratory protection areas.

Workers who are being returned to work with evidence of early MDLD should be subject to more frequent monitoring of their work site to ensure that they are working in low dust locations and activities. The results of this monitoring should prompt a review of the current tasks undertaken and whether any modification is required. It is recommended that there be ongoing periodic SEG-based sampling and periodic personal sampling of the return-to-work individual. The quantity and frequency of sampling should be sufficient to support statistical analysis for comparison with the guideline values, and the principles and methodology described in Recognised Standard 14¹ should be adopted. The protection provided by wearing respiratory protective equipment (RPE) must not be considered when evaluating and applying the exposure guideline values, which should otherwise be assessed as 'unprotected exposure'.

Regarding 'real time continuous dust monitors', the types available have not had their accuracy adequately certified or validated to internationally accepted standards for measuring respirable dust (AS2985 & ISO 7708). These devices may overestimate and/or underestimate gravimetric dust concentration and therefore should not be used to measure and assess personal exposures for comparison with exposure limits. Real time continuous dust monitors should only be used for qualitative purposes to identify dust sources and compare relative concentrations to indicate the effectiveness of dust controls, for which purpose they can be very useful. For example, real time monitoring can quickly highlight potential high intensity exposures during a shift that enables timely response to implement corrective actions.

Enhanced medical surveillance

A minimum of annual health monitoring is recommended for any mine worker diagnosed with MDLD. This involves an annual respiratory review to be carried out by a respiratory physician possessing appropriate occupational lung disease expertise.²

Annual respiratory review includes:

- complete lung function testing with spirometry, lung volumes and single breath diffusion capacity of lung for carbon monoxide (DLCO)
- review of the quarterly dust monitoring data and current work tasks
- chest imaging to include low-dose High Resolution Computed Tomography (HRCT) read by a National Institute for Occupational Safety and Health (NIOSH) certified B-reader Radiologist with special training and/or relevant experience in thoracic radiology utilising the International

¹ Department of Natural Resources, Mines and Energy. 2018. Recognised standard 14. Monitoring respirable dust in coal mines. Queensland Government

² The Thoracic Society of Australia and New Zealand (TSANZ) maintains a register of physicians in Queensland for Occupational Lung Disease at <https://www.thoracic.org.au/information-public/register-of-physicians-in-queensland>

Classification of HRCT for Occupational and Environmental Respiratory Diseases (ICOERD) system, (See Table 1 of ILO-ICOERD comparisons - below)

- review by, or discussion with an occupational physician to provide guidance on return to work and workplace actions, for example, referencing data monitoring.

If subsequent health monitoring reveals evidence of progression of MDLD, it is strongly recommended that the worker be considered for removal from all mine dust exposure and any environment that results in a risk of exposure to mine dust or other respiratory hazards. Specifically, a longitudinal decline of ≥ 15 per cent in spirometry values (in relation to reference values) or a 10-15% decline in DLCO could be considered to be a trigger for further action. Rapid progression of MDLD is defined as an increase in the small opacity profusion by the equivalent of more than one International Labor Organisation (ILO) subcategory over five years, or an increase in the ICOERD score for small opacities by two or more points to an ICOERD score of 4 or greater, or the development of Progressive Massive Fibrosis (PMF). If this is observed, it is recommended that all future work avoids exposure to respirable and inhalable mine dust.

Table 1- ILO/ICOERD Comparisons

ILO Category	ICOERD Score for small opacities
0/-	0
0/0	0
0/1	0
1/0	1-3
1/1	4-5
1/2	6-7
2/1	8-9
2/2	10-11
2/3	12-13
3/2	14-15
3/3	16-17
3/+	18
Category A	Category A
Category B	Category B
Category C	Category C

Return to work recommendations

MDLD: Pneumoconiosis on chest imaging - ILO Category 1 or ICOERD score 1-7

For a worker with confirmed ILO category 1 (1/0, 1/1, 1/2) or ICOERD score 1-7, MDLD, it is recommended that future work involves an environment and tasks that minimise exposure to

respirable mine dust (RMD) ($<0.5 \text{ mg/m}^3$) and respirable crystalline silica (RCS) ($<0.025 \text{ mg/m}^3$). These recommended values are eight-hour time-weighted averages (TWA).

In addition, minimize exposure to inhalable mine dust (IMD) ($< 2.5\text{mg/m}^3$). IMD exposure, while not implicated directly in the development of pneumoconiosis, may contribute to symptoms of chronic bronchitis and lung function impairment. Mine workers exposed to other dusts should have proportionate reductions to the permissible exposure limits for those dusts.

The work areas and controls should be site and task specific and should be determined as part of the initial and subsequent site-based inspections.

The worker should have regular personal dust monitoring to ensure that they are not being exposed to greater levels of respirable mine dust. It is recommended that subsequent personal dust sampling be undertaken on at least a quarterly basis on the affected worker, to ensure consistency across organisations and sites. If any personal dust sampling exceeds the above TWA, then dust mitigation controls need to be reviewed and appropriate corrective action and a review of present tasks undertaken should be triggered.

If optimal control measures are unable to achieve these levels, it is recommended that the worker be transferred to an alternative work area and duties.

It is also recommended that the location and permitted tasks determined involves a site-specific assessment involving the worker, employer, occupational hygienist, and an occupational physician, to determine suitability for each individual case with ongoing monitoring and review.

Annual health monitoring is recommended, at a minimum involving an annual respiratory review.

MDLD: Pneumoconiosis on Chest Imaging - ILO subcategory 2/1 or ICOERD Score 8-9

For a worker with confirmed ILO subcategory 2/1 or ICOERD Score 8-9 MDLD, a return to work could be considered involving environments and work practices that minimise exposure to respirable mine dust (TWA $< 0.5 \text{ mg/m}^3$) and respirable crystalline silica dust (TWA $< 0.025 \text{ mg/m}^3$). In addition, it would be prudent to minimize exposure to inhalable mine dust (IMD) ($< 1.25\text{mg/m}^3$). IMD exposure, while not implicated directly in the development of pneumoconiosis, may contribute to symptoms of chronic bronchitis and lung function impairment.

It is recommended that a site-specific assessment involving the worker, employer, occupational hygienist, and an occupational physician be conducted to determine the location and permitted tasks for each individual case with ongoing monitoring and review.

The worker should have regular personal dust monitoring to ensure that they are not being exposed to greater levels of respirable mine dust. It is recommended that subsequent personal dust sampling be undertaken on at least a quarterly basis on the affected worker, to ensure consistency across organisations and sites. If any personal dust sampling exceeds these limits then dust mitigation controls need to be reviewed and appropriate corrective action and a review of present tasks undertaken should be triggered.

If optimal control measures are unable to achieve these levels, it is recommended that the worker be transferred to an alternative work area and duties; site specific assessment to identify location and permitted tasks will be required to determine suitability for each individual case with ongoing monitoring and review.

Annual health monitoring is recommended, at a minimum involving an annual respiratory review.

MDLD: Pneumoconiosis on chest imaging - ILO subcategory $\geq 2/2$ or ICOERD Score ≥ 10 (CWP, PMF, Mixed Dust Pneumoconiosis or Silicosis)

For a worker diagnosed with ILO 2/2 or ICOERD ≥ 10 MDLD it is advisable that future work avoids exposure to inhalable and respirable mine dust.

This recommendation takes into account interpretation of Queensland industry data and the epidemiological literature on the natural history of advanced CWP, PMF and advanced silicosis in mining industry workers.

Annual health monitoring is recommended, at a minimum involving an annual respiratory review.

The tabulated recommendations for all the different MDLD subgroups can be found in the ‘Enhanced Medical Surveillance Recommendations’ section of the MDLD matrix (see Attachment 1).

Lung function impairment due to MDLD may be obstructive, restrictive, or mixed impairment. This also includes individuals with documented rapid declines in FEV₁.

An individual diagnosed with rapid decline of lung function defined as a drop of more than 15 per cent of reference (using the Global Lung Initiative Reference Standards) in FEV₁ even though the FEV₁ is > the LLN should be considered for referral to a low dust job. It is advisable that future work tasks minimise exposure to inhalable mine dust (IMD) (< 2.5mg/m³), respirable mine dust (RMD) (< 1 mg/m³) and RCS (< 0.025 mg/m³). Table 2 displays the link between the severity of lung impairment and the percentage of reference FEV₁.

For an individual diagnosed with mild lung function impairment (including Chronic Obstructive Pulmonary Disease (COPD)) with an FEV₁ ≥70 per cent and <LLN or DLCO ≥60 per cent and < LLN, it is advisable that future work tasks minimise exposure to inhalable mine dust (IMD) (< 2.5mg/m³), respirable mine dust (RMD) (< 1 mg/m³) and RCS (< 0.025 mg/m³).

Table 2 - Severity of spirometric abnormality based on the forced expiratory volume in one second (FEV₁)

Degree of severity	% of reference FEV ₁
Mild	>70
Moderate	60-<70
Moderately severe	50-59
Severe	35-49
Very severe	<35

Note: Table 2 is adapted from the American Thoracic Society/European Respiratory Society using the Global Lung Initiative Reference Standards³

For a worker diagnosed with moderate lung function impairment with an FEV₁ ≥60–69 per cent or DLCO ≥40–60 per cent, the worker’s ability to perform normal duties may be affected by dyspnoea, persistent cough or reduced exercise capacity. Therefore, the worker’s disease needs to be optimally managed, and a period of treatment and review considered before making a final determination. Once impairment is confirmed, it is advised that future work tasks minimise exposure to IMD (< 1.25mg/m³), respirable mine dust (< 0.5 mg/m³) and RCS (< 0.025 mg/m³).

If the worker with lung function impairment has a moderately severe to severe respiratory impairment (FEV₁ <60 per cent or DLCO <40 per cent), medical management of the worker’s disease needs to be optimized. However, it is likely that the worker will require re-training and re-deployment to avoid further exposure to respiratory hazards⁴.

³ Stanojevic S, Graham BL, Cooper BG, et al. Official ERS technical standards: Global Lung Function Initiative reference values for the carbon monoxide transfer factor for Caucasians. *Eur Respir J.* 2017;50(3). doi:10.1183/13993003.00010-2017 and Quanjer PH, Stanojevic S, Cole TJ, et al. Multi-ethnic reference values for spirometry for the 3–95-yr age range: the global lung function 2012 equations. *Eur Respir J.* 2012;40(6):1324-1343. doi:10.1183/09031936.00080312

⁴ Refer to sections 220 and 228 of the *Workers’ Compensation and Rehabilitation Act 2003*

The tabulated recommendations for all the different Lung Function Impairment subgroups can be found in 'Enhanced Medical Surveillance Recommendations' section of the MDLD matrix (see Attachment 1).

For all workers diagnosed with lung function impairment, it is recommended that a site-specific assessment involving the worker, employer, occupational hygienist, and an occupational physician is conducted to determine the location and permitted tasks and suitability for each individual case with ongoing monitoring and review.

The worker should have regular personal dust monitoring to ensure that they are not being exposed to greater levels of inhalable or respirable mine dust. It is recommended that subsequent personal dust sampling be undertaken on at least a quarterly basis on the affected worker, to ensure consistency across organisations and sites. If any personal dust sampling exceeds these limits, then dust mitigation controls need to be reviewed and appropriate corrective action and a review of present tasks undertaken should be triggered.

If optimal control measures are unable to achieve these levels, it is recommended that the worker be transferred to an alternative work area and duties. The location and permitted tasks determined will require site specific assessment to determine suitability for each individual case with ongoing monitoring and review.

A number of factors may have a bearing on a worker's return to work, such as the nature and extent of respiratory impairment, the likelihood and extent of ongoing exposure to mine dust and fumes, a history of symptomatic exacerbations attributed to mine dust exposure and/or fumes. Irrespective of the degree of respiratory impairment, if an affected worker with lung function impairment experiences significant exacerbation of respiratory symptoms as a result of exposure to mine dust and/or fumes, measures will need to be taken to avoid such exposure/s. The affected worker should be advised to cease smoking cigarettes if relevant.

Annual health monitoring is recommended, at a minimum involving an annual respiratory review.

MDLD without lung function impairment

For a worker with radiological evidence of 'MDLD without pneumoconiosis' (e.g. Emphysematous changes) on HRCT but with a normal spirometry and complex lung function testing result, it is recommended that annual health monitoring is undertaken at a minimum involving an annual respiratory review.

The recommendations for this worker cohort align with the Enhanced Medical Surveillance Recommendations 'Spirometry FEV1 values >70 per cent and < LLN' section of the MDLD matrix (see Attachment 1).

Additionally, serial chest imaging with low-dose HRCT read by a NIOSH accredited B reader Radiologist should be considered and determined at the discretion of the treating respiratory physician on a case-by-case basis.

Dust-related diffuse fibrosis

For a worker with confirmed dust-related diffuse fibrosis (DDF), largely irregular opacities on chest imaging, it is recommended that decisions regarding future work follow the recommendations for pneumoconiosis based on the profusion of small irregular opacities; see recommendations above. Lung function impairment in these workers should also be used to guide return to work, especially the degree of impairment of diffusion capacity.

Overlap of pneumoconiosis on chest imaging and lung function impairment

Often workers may have both pneumoconiosis on chest imaging and lung function impairment. In these cases, the worker should receive follow up based on the minimum imaging requirements for their stage of pneumoconiosis and lung function testing follow up also based on the minimum

requirements for surveillance of workers with that degree of lung function impairment as noted in the tables below.

Non-standard work cycles

The risk of developing MDLD is directly related to the retained lung burden of respirable mine dust or RCS, as a result of cumulative long-term inhalation exposure to mine dust. It is not based on a one-off high intensity exposure event. The time-weighted average (TWA) exposure standards in Australia apply to long term exposure to a substance over an eight-hour day, five-day working week, for an entire working life.

If the worker is working a non-standard work cycle greater than 40 hours per week, there is a need to reduce the airborne concentration to less than the published exposure limit by applying a weekly reduction factor.

The reduction factor (RF) is calculated based on the Quebec Model⁵:

RF weekly = 40 / weekly exposure hours

Example: A roster work cycle of 14 shifts on and seven shifts off with 12 hours per shift equates to an average of 56 hours worked per week. The RF weekly is $40 / 56 = 0.71$. Therefore, if a worker with CWP 1/1 is returning to a work roster involving an average of 56 hours per week, an RF of 0.8 is applied to the above-mentioned recommended exposure limits for inhalable mine dust (IMD) ($< 2.5 \text{ mg/m}^3$) respirable mine dust ($\leq 0.5 \text{ mg/m}^3$) and respirable crystalline silica dust ($\leq 0.025 \text{ mg/m}^3$).

Psychological factors impacting on return to work

Some workers diagnosed with MDLD may experience a high degree of stress and anxiety in relation to returning to mine work. This may be due to the effects of the illness, other medical or psychological comorbidities, or concerns in relation to the potential for disease progression. It is acknowledged that some workers diagnosed with MDLD will express a preference to avoid any work that involves exposure to mine dust.

Conversely, some workers diagnosed with MDLD, especially if they have minimal or no symptoms and no significant impairment, may express a strong preference to remain in their normal work environment and job and express great anxiety about the possibility of job loss, or being relegated to jobs that are not perceived as important. They may also be affected by being separated from their work colleagues when they are asked to transfer to low dust occupations.

The best possible return to work outcomes can be facilitated by key stakeholders communicating and collaborating effectively to understand and overcome potential barriers or obstacles to return to work.

⁵ (Note reference is 'Adjustment of atmospheric contaminant exposure standards – guide' (March 2019) Department of Mines, Industry Regulation and Safety, WA Government)

Enhanced medical surveillance recommendations for different lung function impairment subgroups

In all conditions and 'overlap' conditions (e.g. CWP plus lung function impairment), the worker should receive at least the minimum chest imaging for their stage of pneumoconiosis and the minimum complex lung function follow up as needed for their degree of lung function impairment.

Spirometry FEV₁ values (Pre-Bronchodilation % Predicted)	DLCO values (% predicted)	Restrictions (Time weighted average)	Enhanced medical surveillance recommendations
Rapid decline in FEV ₁ defined as >15 per cent fall in reference value even if FEV ₁ > LLN		<1mg/m ³ RCD <0.025mg/m ³ RCS <2.5mg/m ³ IMD	Annual Respiratory Review CLFS Quarterly dust monitoring data and review of work tasks
> 70 per cent & <LLN (Mild)	>60 per cent & <LLN (Mild)	<1mg/m ³ RCD <0.025mg/m ³ RCS <2.5mg/m ³ IMD	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks
60 – 69 per cent (Moderate)	40 – 60 per cent (Moderate)	<0.5mg/m ³ RCD <0.025mg/m ³ RCS <1.25mg/m ³ IMD	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks
50-59 per cent (Moderately severe)	<40 per cent (Severe)	Case by case: usually exclude from dust exposure	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks (if applicable)
35-49 per cent (Severe)		Usually not fit for work Exclude from dust exposure	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks (if applicable)

DLCO values (% predicted)	Restrictions (Time weighted average)	Enhanced medical surveillance recommendations
>60 per cent & <LLN (Mild)	<1mg/m ³ RCD <0.025mg/m ³ RCS <2.5mg/m ³ IMD	Annual Respiratory Review CLFS Quarterly dust monitoring data and review of work tasks
40 – 60 per cent (Moderate)	<0.5mg/m ³ RCD <0.025mg/m ³ RCS <1.25mg/m ³ IMD	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks
<40 per cent (Severe)	Case by case: usually exclude from dust exposure	Annual Respiratory Review* CLFS Quarterly dust monitoring data and review of work tasks (if applicable)

ILO CXR Classification	HRCT ICOERD Classifications	Restrictions	Enhanced medical surveillance recommendations
≥1/0 & < 2/1 Or 1/0, 1/1 & 1/2	≥1 through 7	<0.5mg/m ³ RCD <0.025mg/m ³ RCS <2.5mg/m ³ IMD	Annual respiratory review HRCT thorax CLFS Dust monitoring data and review of work tasks
2/1	8-9	<0.5mg/m ³ RCD <0.025mg/m ³ RCS <1.25mg/m ³ IMD	Annual respiratory review HRCT thorax CLFS Dust monitoring data and review of work tasks
≥2/2 and Category A, B, C PMF	≥10 and Category A, B, C PMF	Case by case: usually exclude dust	Annual respiratory review HRCT thorax CLFS* Dust monitoring data and review of work tasks (if applicable)

Notes

- Annual review is considered the standard interval unless additional concerns
- *Serial imaging at the discretion of the respiratory physician on a case-by-case basis

In all conditions and 'overlap' conditions (e.g. CWP plus lung function impairment), the worker should receive at least the minimum chest imaging for their stage of pneumoconiosis and the minimum complex lung function follow up as needed for their degree of lung function impairment.

DDF: recommendation based on whichever is the worst - profusion of small opacities (ILO grade), Spirometry, DLCO values.

Abbreviations

CLFS	Complex lung function studies *Consider Cardiopulmonary Exercise Testing (CPEX)
COPD	Chronic Obstructive Pulmonary Disease
CWP	Coal Workers' Pneumoconiosis
DLCO	Diffusing capacity of lung for carbon monoxide
HRCT	High Resolution Computed Tomography
ICOERD	International Classification of HRCT for Occupational and Environmental Respiratory Diseases
ILO	International Labor Organisation
IMD	Inhalable Mine Dust
SEG	Similar Exposure Group
MDLD	Mine Dust Lung Disease
OH	Occupational Hygienist
NIOSH certified b-reader	A physician certified by the National Institute for Occupational Safety and Health as demonstrating proficiency in classifying the radiographs of the pneumoconioses

PMF	Progressive Massive Fibrosis
RCD	Respirable coal dust
RCS	Respirable crystalline silica
RMD	Respirable mine dust
RCS	Respirable crystalline silica
TWA	Time weighted average



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