



# ANGLO AMERICAN FATAL RISK STANDARDS



# INTRODUCTION

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The Anglo American Vision is to achieve Zero Harm through the effective management of safety at all businesses and operations. Experience has shown that we are susceptible to a number of high-level hazards that may lead to death or serious injury. Anglo American has developed a set of mandatory standards to address these high-level hazards and to eliminate or minimise the risk of fatalities and injuries.

The **Anglo American Fatal Risk Standards** have been developed by examining industry best practice and by utilising our own experience of fatal incidents. The **Anglo American Fatal Risk Standards** establish the minimum performance requirements for managing the identified fatal risks.

The **Anglo American Fatal Risk Standards** do not represent comprehensive coverage of all fatal risks faced by our operations but focus on the risks that have resulted in the majority of fatalities in recent years.

CONTEXT

The Anglo American Fatal Risk Standards are an element of the Anglo American Safety Framework. They form an integral part of Anglo American’s corporate safety leadership policies and standards. Their position in the Anglo American Safety Framework is illustrated below.

APPLICATION

These Standards apply to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

REQUIREMENTS

Application of the Anglo American Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

- 1) Documented and detailed description of the implementation difficulties.
- 2) Documented and detailed risk assessment of the situation under proposed alternative control measures.
- 3) Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

RISK-BASED APPROACH

The Anglo American Fatal Risk Standards represent current best practice in the control of the specific identified fatal risks and have been derived from detailed risk assessments, investigations into fatal incidents and the experiences of other industry leaders.

The Anglo American Fatal Risk Standards form only a part of the requirements to prevent fatal incidents. The ongoing risk-management processes (as required by Standard 2 of the Anglo American Safety Way) will assist in identifying the additional controls and associated management activities required to facilitate effective management of fatal risks. These controls shall be implemented in addition to the Anglo American Fatal Risk Standards to ensure they remain appropriate and effective.

Anglo American owns and operates a diverse range of businesses and operations in different countries and cultures around the world, with varying legal frameworks. When applying procedures and practices to meet the requirements of these Standards, all relevant local and national legislation shall be complied with. Where the local legislation prescribes standards that are below the requirements of the Anglo American Group (including the Anglo American Fatal Risk Standards), the Anglo American Fatal Risk Standards will take precedence and be applied.

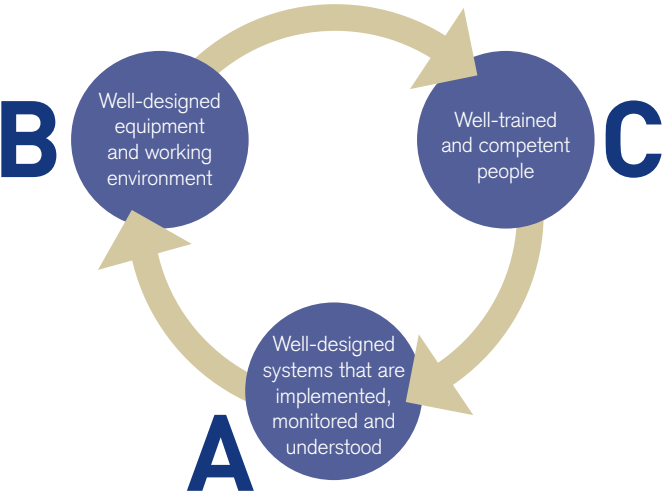
SELF-ASSESSMENT TOOL

Annual use of the self-assessment tool for evaluating compliance against the requirements of the Anglo American Fatal Risk Standards is mandatory and shall be verified in peer reviews.

It will also facilitate tracking of compliance with the Anglo American Fatal Risk Standards in a standardised format throughout Anglo American.

STRUCTURE OF THE ANGLO AMERICAN FATAL RISK STANDARDS

The requirements of these Standards are classified in three broad focus areas:



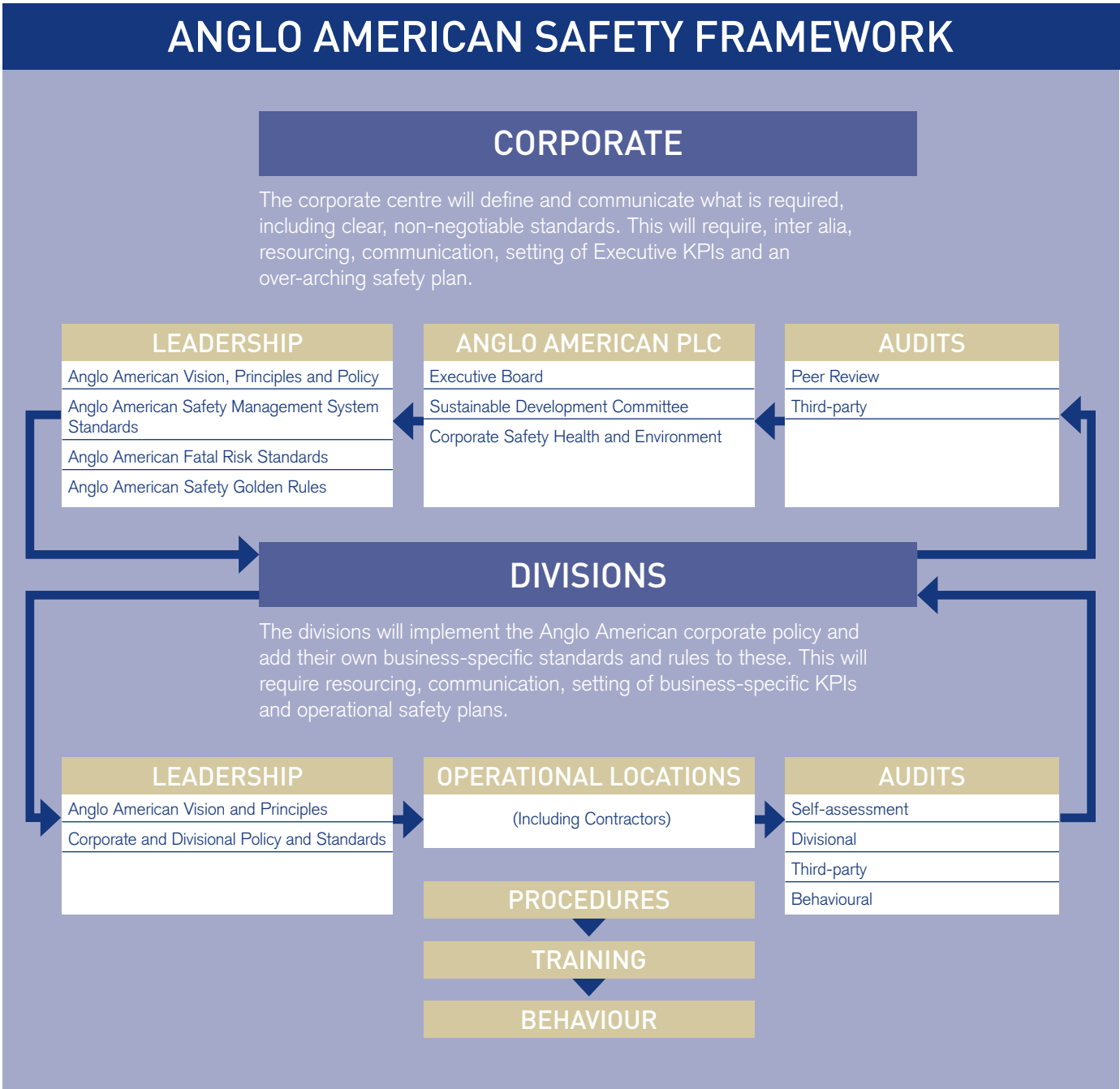
- A System and Procedural Requirements
- B Plant and Equipment Requirements
- C People Requirements

These three areas cover the essential controls that must be in place in order to manage these risk categories comprehensively.

ANGLO AMERICAN FATAL RISK STANDARDS AND THE ANGLO AMERICAN SAFETY GOLDEN RULES

The Anglo American Fatal Risk Standards are specific controls associated with identified fatal risks. They include the infrastructure, systems and behaviours required to encourage effective management of fatal risks.

The Anglo American Safety Golden Rules focus on the behavioural requirements of people and the Anglo American Fatal Risk Standards, which are directed primarily at management, focus on the three broad areas listed above. The Anglo American Safety Golden Rules remain in place and continue to be mandatory at all Anglo American Group managed businesses and operations.



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# AFRS 1: LIGHT VEHICLES STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the use of light vehicles in surface operations.

## 2 APPLICATION

This Standard applies to all light vehicles used for work-related activities and for transporting people and light loads. Examples of light vehicles covered by this Standard are passenger cars, four-wheel drives (including all-wheel drives), sports utility vehicles (SUVs), pick-ups (utilities, bakkies) and mini-buses.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

## 3 DEFINITIONS

A “light vehicle” is a vehicle which;

- a) can be licensed and registered for use on a public road
- b) has four or more wheels
- c) seats a maximum of 12 adults (including the driver)
- d) when registered, can be driven legally on a public road by a driver issued with a standard basic-level public road driver’s licence
- e) does not exceed 4.5 tonnes gross vehicle mass (GVM), which is the maximum loaded mass of the motor vehicle as specified by:
  - The vehicle’s manufacturer, OR
  - An approved and accredited automotive engineer, if the vehicle has been modified to the extent that the manufacturer’s specification is no longer appropriate.

Any light vehicle falling outside of this group should refer to the Surface Mobile Equipment standard.

Light vehicles may include the following categories of vehicles being used for work-related activities:

- a) Anglo American owned or leased vehicles;
- b) Hire vehicles (for example Budget or Hertz rental vehicles);
- c) Contractor or supplier vehicles operating on company property;
- d) Private vehicles (personal or hired) used for work-related activities.

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## 4 REASON FOR INCLUSION

Light vehicles have been involved in a significant proportion of our fatal and high-potential incidents. Identified causes and contributing factors include:

- a) Inappropriate speed for conditions;
- b) Driver fatigue;
- c) Vehicle instability;
- d) Driver distraction;
- e) Poor vehicle condition (tyres, brakes, etc.);
- f) Driver under the influence of alcohol or drugs;
- g) Poor visibility;
- h) Lack of vehicle separation from other mobile equipment, plant and pedestrians;
- i) Risk-taking behaviour by the driver;
- j) Driver inexperience/incompetence.

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## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
  2. Documented and detailed risk assessment of the situation under proposed alternative control measures
  3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.
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## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. Light vehicles shall have the following minimum safety features:
  - Suitable seat belts for all occupants;
  - Roll-over protection for all vehicles intended to be driven on dirt or steep roads;
  - Cargo barriers and load restraints for all vehicles designed for carrying loads (other than passengers), or that are unable to have cargo separated from the vehicle's occupant-carrying space;
  - Driver-side air bag.
2. Light vehicles that interact with heavy mobile equipment and/or plant shall have:
  - Systems that enable positive communication with the equipment and/or plant;
  - High-visibility flag (e.g. a whip flag or buggy whip);
  - Flashing, revolving or strobe light;
  - High-visibility colour;
  - Reflective taping.
3. Light vehicles operating on site should be fitted with signage allowing for easy and positive vehicle identification from a reasonable distance.
4. Light vehicles should have:
  - First aid kit;
  - Emergency roadside triangles or beacons (three of either);
  - Survival or emergency equipment suitable for the operating environment.
5. A change management process shall accompany all vehicle modifications, including the attachment of any equipment. Examples of changes or modifications may include, but not be limited to:
  - Any change or modification made to the overall vehicle body structure or design;
  - Any change or modification made to the original manufacturer fitted type of tyres or wheels;
  - Any change or modification made to the vehicle suspension system;
  - Any change or modification made to the vehicle's mechanical system;
  - Any change or modification that may alter adversely the vehicle's centre of gravity;
  - Any change or modification that alters the vehicle's load-carrying capacity;
  - Any change or modification that may affect the vehicle's ability to withstand a crash (e.g. the fitment of a "bull bar").



## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

6. Vehicle selection shall be based on risk assessment taking account of tasks, application, environment, roll-over protection and rating of sturdiness in the event of a crash.
7. A formal inspection and preventative/condition-based maintenance system shall be in place to ensure that vehicles are maintained in a safe and roadworthy condition and, as a minimum, are serviced in line with the vehicle manufacturer's service schedule. Inspection and maintenance shall be undertaken on critical items such as:
  - Wheels and tyres;
  - Steering, suspension and braking systems;
  - Seats and seat belts;
  - Lamps, indicators and reflectors;
  - Windscreen and windows, including windscreen wipers and washers;
  - The vehicle structure itself;
  - Other safety-related items on the vehicle body, chassis or engine, including instrumentation.
8. Seat belts shall be used in all cases by all occupants.
9. A pre-operation vehicle safety check and familiarisation system shall be in place and used by the driver.
10. Systems shall be in place to ensure that risks associated with vehicle journeys are managed and controlled. The systems shall include, but not be limited to:
  - Journey management plans in place prior to commencement of new or changed travel activities;
  - Identification and monitoring of the risks associated with the number of journeys, routes, intersections, etc. To ensure that the overall exposure is reduced;
  - Assessment and communication of changed environmental and road conditions at the time of travel;
  - Outline of actions required in the event of an emergency (e.g. collision or breakdown);
  - Provision to manage driver fatigue.
11. Light vehicle running lights (low-beam headlamps) shall be switched on at all times when the vehicle is in operation.
12. Mobile telephones, whether hands-free or not, shall be used by the driver of a vehicle only when the vehicle is stationary and in a safe location.
13. Controls shall be in place to ensure the safety of people working on roads, including those working on broken-down vehicles.
14. A site-based review of pedestrian interaction, road design and layouts (including entrance and exit points, intersections and other potential points of interaction between light vehicles and other mobile equipment) shall be conducted and shall be updated when changes to layouts are required. Where possible, traffic segregation should be used to separate pedestrians, light vehicles and other mobile equipment.



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15. A site-based traffic management plan shall be in place including, but not limited to:
- Setting of appropriate speed limits for vehicle types, road surfaces and environmental conditions;
  - Overtaking standards;
  - Procedures for light vehicles entering hazardous or restricted areas;
  - Clear communication protocols;
  - Standards for safe following distances based on operational circumstances, environmental conditions and near sight (blind spot) limitations of other mobile equipment;
  - Installation and maintenance of road traffic control signs as appropriate to the work site;
  - Parking procedures (e.g. safe parking distances/locations) and required barriers from heavy mobile equipment and pedestrians.
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## 8 PEOPLE REQUIREMENTS

16. All employees, contractors and visitors shall be inducted in appropriate road safety and site vehicle hazards.
17. A permit or certification system shall be in place to ensure drivers are competent to operate the type of vehicle/s in the intended environment, whether that is internal or external to an Anglo American site.
18. A system shall be in place to verify that drivers of Anglo American vehicles have a valid and appropriate level public road driver's licence prior to being allowed to operate an Anglo American vehicle off site.
19. A system shall be in place to ensure that drivers receive adequate training to ensure that the vehicle intended to be operated or driven can be operated or driven safely. As a minimum, training should include:
- Behaviour-based defensive driving principles;
  - Vehicle familiarisation, taking into account the vehicle's handling dynamics, maximum number of passengers, load limits and various features;
  - Loading and restraining principles where the vehicle to be operated is designed for carrying cargo loads;
  - Education about and awareness of driving and travel risks that may be encountered within the environment where the vehicle may be operated or driven and the requirements of keeping to traffic rules and speed limits;
  - Securing (locking) equipment to prevent unauthorised use;
  - Emergency crash and breakdown procedures;
  - Basic mechanical principles, including how to change a tyre and perform an adequate pre-operation check.
20. A system shall be in place to ensure that persons operating any equipment associated with a light vehicle (e.g. vehicle-mounted cranes and winches) are suitably trained and accredited.
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21. Behaviour-based observations shall include the operation of light vehicles. Any need for additional specific retraining shall incorporate the results of these observations.
  22. A fit-for-work policy shall be in place, incorporating the clearly-defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of drivers/operators.
  23. A system shall be in place to manage driver fatigue, including:
    - A formal system to be used on site;
    - A risk assessment and procedures for off-site driving.
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## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 27, AFRS 1: Light Vehicles Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 1(Dr. J. Wannenburg, May 2011)

For more information or to give feedback on this document, please contact [M&T Risk and Assurance](#) Tel +27 11 638 2815

# AFRS 2: SURFACE MOBILE EQUIPMENT STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the use of surface mobile equipment.

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## 2 APPLICATION

This Standard applies to surface mobile equipment such as rear dump, belly dump and water trucks, graders, dozers, loaders and pressurised road and rail tankers. Where surface mobile equipment falls outside these groups (e.g. draglines, shovels, excavators, forklifts, mobile cranes, buses, backhoes, bobcats and other trucks larger than light vehicles), the application of some requirements of this Standard may not be practicable. In these cases, a risk-based approach shall be used to determine the level of compliance needed for each of the specific requirements.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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## 3 DEFINITIONS

None

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## 4 REASON FOR INCLUSION

Surface mobile equipment has been involved in a significant proportion of our fatal and high-potential incidents. Identified causes and contributing factors include:

- a) overtaking
  - b) ineffective communications
  - c) loss of traction
  - d) poor visibility
  - e) overturning
  - f) dropped loads
  - g) reversing
  - h) structural failure
  - i) unplanned movements on slopes and inclines
  - j) brake failure
  - k) operator error due to fatigue and substance abuse
  - l) parking protocols
  - m) non-adherence to operating procedures.
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## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

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The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
2. Documented and detailed risk assessment of the situation under proposed alternative control measures
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 6 PLANT EQUIPMENT REQUIREMENTS

1. Surface mobile equipment shall have the following minimum safety specifications:
  - seat belts for all occupants
  - adequate lighting (e.g. headlights, tail, turn, brake, strobe, flashing lights)
  - identified isolation/lockout point in accordance with the Isolation Standard
  - adequate walkways, railing, steps/grab handle combinations and boarding facilities, including an alternative path of disembarking in case of emergency
  - collision-avoidance technology and/or procedures
  - reversing alarms
  - chock blocks for rubber-tyred surface mobile equipment
  - horn
  - effective windscreen wipers
  - effective guarding on accessible moving parts (consistent with the Equipment Safeguarding Standard)
  - signage on the equipment that allows clear and easy identification from a distance
  - security systems to prevent unauthorised operation.
2. Surface mobile equipment should have the following minimum safety specifications, unless exempted by risk assessment:
  - approved or certified roll-over protection (ROP)
  - fail-to-safe brakes
  - a fire-detection and suppression system capable of being activated from both

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- ground and cabin levels
  - non handheld two-way radio or other forms of communication
  - falling object protection (FOP)
  - enclosed and tightly-sealed air-conditioned cabins, with consideration of requirements for noise and dust suppression systems and suitable protective glass (e.g. toughened, laminated, shatterproof)
  - a method for transporting supplies and personal items to and from the operator cabin (e.g. a back pack or shoulder strap bag) to enable drivers to maintain three points of contact continuously while mounting and disembarking from the equipment
  - safety checks, supports, interlocks, etc. to be used when working on the machine.
3. Advances in technology for collision avoidance, safety management systems, fleet management and visibility improvement shall be monitored and appropriate engineering reviews should be conducted to determine whether new technology should be implemented or used.
  4. Design, inspection and maintenance requirements should be in place for all roadways including collision protection of hazardous and critical plant and equipment. Risk assessments should be carried out prior to any changes to traffic movements.
  5. Systems (such as safety berms) shall be in place along roadways, excavations and dump areas to prevent vehicles from entering dangerous areas as determined by risk assessment.
  6. Layout of cabins should take into consideration the ergonomics of seating, operator controls and retrofitted devices.
  7. Fleet and control consistency should be considered, where possible, to minimise operator error when changing machines.
  8. All pressurised road and rail tankers shall be subjected to a bi-annual inspection in accordance with Anglo American specifications and local health and safety regulations. The manufacturing certificate and inspection records shall be submitted to the access control point prior to entering an Anglo American site.
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## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

9. Seat belts shall be used in all cases by all occupants.
  10. A formal risk-based selection and acceptance process shall be in place for all new (to site) and modified surface mobile equipment prior to commencement of work on site.
  11. Selection of equipment, and any modification to equipment, shall be subjected to a rigorous change management process.
  12. A procedure and checklist system, including a brake functionality test, shall be in place for pre-operation inspection by the operator. Logs shall be maintained on the machine and audited.
  13. Procedures shall be in place to ensure vehicles are not overloaded.
  14. Procedures shall be in place to ensure surface mobile equipment operates only on sufficiently stable surfaces and on gradients that are within the limits of safe operation.
  15. A post-maintenance (scheduled or breakdown) machine test shall be conducted.
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16. On-the-job risk assessments shall be conducted as part of the planning process for surface mobile equipment operations, including maintenance and other activities.
17. Adequate road maintenance, dust control and water management plans for roads, mining and haulage operations shall be in place. Consideration shall be given to extreme wet weather and the over-watering of roads.
18. Parking standards shall include requirements for the immobilisation of surface mobile equipment (e.g. chocking or the use of ditches/trenches) and consideration for breakdown maintenance activities.
19. An inspection and maintenance programme shall be in place for surface mobile equipment, including critical equipment and components.
20. A site-based traffic management plan should be in place including, but not limited to:
  - segregation of pedestrians, light vehicles and heavy mobile equipment, where possible
  - clear instructions about where pedestrians must give way to vehicles
  - systems to alert mobile equipment operators of the presence of pedestrians
  - setting of appropriate speed limits and the installation and maintenance of road signage
  - right-of-way rules (including overtaking restrictions)
  - access planning in areas identified as hazardous and having significant associated risks
  - systems to control movement of mobile equipment in areas accessible to pedestrians, into and out of workshops, and for controls on pedestrian and light vehicle movement around mobile equipment
  - designated parking areas for heavy vehicles and light vehicles, including around maintenance areas
  - systems to control approaching, refuelling, parking, boarding, disembarking and isolation by production and maintenance crews and other pedestrians
  - clear instructions that equipment operators or drivers shall be out of the cabin and dismounted to ground level when their direct involvement with maintenance or servicing is not required
  - guidelines for abnormal road conditions (e.g. rain, high winds) giving “go/no go” criteria and stating the responsible person for this decision
  - clear communication procedures for interactions between all vehicles
  - truck loading/unloading procedures to avoid material or objects falling from the vehicle
  - guidelines for wide or abnormal loads, including off-site transport
  - systems to control equipment use within the vicinity of overhead power lines.
21. Risk assessments shall be carried out prior to any changes to traffic movements or road systems.
22. Procedures should be in place to provide details of the maintenance tasks that an operator is allowed to perform and the operations that maintenance personnel can carry out under testing conditions.

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23. A tyre management system shall be in place to address issues including fire, heating, explosion, electrical contact, separations, maintenance, tyre changes, etc.
  24. Mobile telephones, whether hands-free or not, shall be used by the driver of surface mobile equipment only when it is stationary and in a safe location.
  25. A procedure shall be in place for the checking and verification of inspection records of pressurised road and rail tankers prior to such vehicles accessing an Anglo American site.
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## 8 PEOPLE REQUIREMENTS

26. Recruitment and induction processes for surface mobile equipment operators shall encompass past work history, site testing and comprehensive medical examinations that confirm fitness for work.
  27. Site and area induction of operators shall be performed prior to starting work in a new area.
  28. A permit or certification system shall be in place to ensure drivers are competent to drive on site, including the ability to respond under emergency conditions. In addition, a system shall be in place to verify that operators of Anglo American vehicles have a valid driver's licence prior to operating Anglo American vehicles off-site.
  29. A fit-for-work policy shall be in place, incorporating the clearly-defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of drivers/operators.
  30. A system shall be in place to manage driver-fatigue.
  31. Behaviour-based observations shall include the operation of surface mobile equipment. Any need for additional specific re-training shall incorporate the results of these observations.
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## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 28, AFRS 2: Surface Mobile Equipment Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 2 (Dr. J. Wannenburg, May 2011)

# AFRS 3 - HAZARDOUS MATERIALS MANAGEMENT STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, illnesses, injuries and incidents arising from the storage, handling, production, transport, recycling and disposal of hazardous materials.

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## 2 APPLICATION

This Standard applies to hazardous materials in Major Hazard Installations (MHI) that, in one or more of their forms (solid, liquid or gas), have the potential to lead to harm to people, the environment or community (all stakeholders), either in an incident involving loss of control or in normal, controlled activities (e.g. storage, handling, production, transport, recycling and disposal). Where hazardous materials, processes or facilities do not qualify as Major Hazard Installations, some requirements of this Standard may not be practicable. In these cases, a risk-based approach shall be used to determine the level of compliance required. This Standard does not cover handling of explosives or radioactive materials, for which specific procedures shall be in place.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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## 3 DEFINITIONS

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**HAZOP** : A HAZard and OPerability study is a useful tool in evaluating any inherent hazards or operational problems. The technique enforces a structured, systematic examination of complex process facilities.

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**HAZID:** : A (HAZard IDentification) is high level hazard identification that typically addresses the overall project, not only the process equipment.

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**MSDS** : A Material Safety Data Sheet (MSDS) is a document that contains information on the potential health effects of exposure to chemicals, or other potentially dangerous substances, and on safe working procedures when handling chemical products. Each MSDS must contain a minimum of sixteen sections, as prescribed by international standards.

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**HAZCHEM** : This is a code system developed to provide immediate action advice when dealing with a chemical incident. Chemicals are assigned a code e.g. 3Y on the basis of the hazard that they represent and the required emergency response.

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**MHI** : Major Hazard Installation that holds a quantity of a hazardous substance which may pose a risk that could fatally affect the health and safety of employees and the public.

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## 4 REASON FOR INCLUSION

Hazardous materials have caused several fatalities and continue to contribute to the number of significant incidents at Anglo American businesses and operations. They are associated with uncontrolled releases and have the potential to affect a wide area around the incident (e.g. gases can travel significant distances). It is, therefore, essential to ensure that equipment; processes and behaviours are developed and adopted to manage the risks associated with these materials.

The causes of and factors contributing to these incidents have been:

- Failure to recognise the risk/at-risk maintenance activities;
- Lack of understanding of chemical properties and reactions;
- At-risk manual handling activities;
- Insufficient management of risk/lack of change management;
- Inadequate emergency response;
- Equipment failure;
- Inadequate design.

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## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
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  3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.
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## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. The basis of design of a facility or process, whether permanent or temporary, which transports, produces, stores, uses or disposes of hazardous materials shall be reviewed (preferably with the vendor), amended as necessary and documented, utilising a process risk assessment tool such as HAZOP, HAZID, etc. As-built design drawings (e.g. process and instrumentation diagrams, process flow diagrams, layout drawings, isometrics, software upgrades, etc.) shall be updated as a result of these reviews.
2. All specifications for the location, design and/or modification of hazardous materials facilities shall be subjected to risk assessment that includes materials selection, site conditions, transport, production, storage, handling, use and disposal. Previous incidents shall be reviewed.
3. All facilities which have a significant risk from hazardous substances shall provide a risk-based emergency response plan which includes:
  - emergency response procedures appropriate to the hazardous materials and the risk
  - emergency equipment/facilities (e.g. oxygen, antidotes, showers, etc.) on location where hazardous materials are stored or used
  - means of escape in an emergency situation
  - clearly marked emergency isolation valves
  - emergency response teams appropriate to the risk
  - appropriate use of safe refuge and assembly areas for people
  - Emergency response equipment for spillage containment, fires, explosions, burns, etc.
  - Appropriate response arrangements with external emergency services (e.g. ambulance, hospitals, fire brigade, medical personnel, etc.)
  - impact minimisation including spill clean-up and dust suppression
  - Recovery procedures and disposal of the hazardous material.
4. Provisions shall be made for the safe venting, drainage and containment required during normal operations and in emergency situations, based on a process risk assessment tool such as HAZOP and HAZID.
5. Labelling shall be in place on all storage vessels, containers and tanks, as per appropriate national or international standards. This labelling shall clearly identify the carried or stored material. Supporting information (e.g. material safety data sheets [MSDS]) shall also be readily available at the point of use and storage to identify appropriate first aid/spill response procedures.
6. Piping containing hazardous substances shall be clearly marked so that the contents and direction of flow can be identified.
7. Security and access control systems and hardware shall be in place, appropriate to the risk, to manage access to areas where hazardous materials are stored and used.
8. Process control systems shall ensure that the potential for personnel to be exposed to hazardous materials is eliminated, wherever possible, or reduced.



9. Automatic plant control systems should be in place in hazardous material facilities to eliminate the need for operator intervention and to maintain operation within the required parameters. Such systems shall incorporate fail-to-safe systems in the event of emergencies. Where automatic control is not practicable, risk assessment shall be used to identify and implement operational options that reduce the risk.
10. Fixed detectors and personal detection devices shall be considered as options in the selection of potential risk reduction measures.

## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

1. Management of risk associated with hazardous materials shall be supported by a documented process that incorporates risk reduction using the Hierarchy of Controls, applied in the following order (a number of these options may be considered and applied individually, or in combination):
  - ELIMINATE – the complete elimination of the hazard;
  - SUBSTITUTE – replace the material or process with a less hazardous one;
  - RE-DESIGN – re-design the equipment or work processes;
  - SEPARATE – isolating the hazard by guarding or enclosing it;
  - ADMINISTER – provide controls such as training, procedures, etc. ;
  - PERSONAL PROTECTIVE EQUIPMENT (PPE) – use appropriate and properly fitted PPE where other controls are not practicable.
2. A risk assessment process shall be in place to identify:
  - The selection criteria and life cycle analysis for all hazardous materials;
  - The level of risk associated with the hazardous materials;
  - Controls required to manage the risk;
  - The performance requirements (reliabilities and capacities) of specific equipment and systems included in these controls.
3. A system shall be in place to identify and document maintenance, inspection, testing schedules and procedures for critical equipment associated with hazardous materials.
4. A system shall be in place to ensure that the introduction and disposal of hazardous materials, including containers, shall be approved by the site Hazardous Materials Co-ordinator (refer Element 29) prior to introduction or disposal.
5. A system shall be in place for the management of change of equipment and/or processes for transportation, storage handling, use and disposal shall include specific steps to assess the impact of changes on the risk associated with hazardous materials.
6. A site register shall be in place for all hazardous materials, and include the following:
  - name
  - HAZCHEM/United Nations (UN) code
  - MSDS
  - summary of maximum inventory
  - storage requirements and precautions

- location and physical properties of the materials when they are in use
  - Inventory of special emergency items held for handling of spillages, fires, etc. (e.g. reagents to neutralise spillages and accidental releases, fire fighting foam, etc.)
  - Approved disposal methods.
7. A system shall be in place to ensure that MSDS are available to all personnel (including emergency response, first-aid and medical personnel) involved in the transportation, storage, handling, use and disposal of hazardous materials on site.
  8. A system shall be in place to ensure that all relevant design documents and drawings associated with this Standard are up to date, controlled and available.
  9. Critical activities, which involve hazardous materials and have the potential for immediate or long-term harm, shall be identified and safe operating procedures shall be documented, including transportation, storage, handling, use and disposal of incompatible hazardous substances.
  10. Safe operating limits for plant and equipment handling hazardous materials which have the potential for immediate or long-term harm, shall be clearly defined, documented and available to operational and maintenance personnel.
  11. Monitoring systems for hazardous materials shall be in place to ensure that the status of operation is understood and shown clearly at all times. These systems shall include the procedure for a documented hand-over between shifts that records any relevant information/changes in operating status.
  12. A permit-to-work system, in line with the definition in the Isolation Standard, shall be in place to ensure proper decontamination of plant and equipment, isolation, use of the correct personal protective equipment, and any special requirements or precautions (e.g. requirements for testing, venting, clearing of piping or when using naked flames) where the occupational exposure limit to a hazardous substance could be exceeded.
  13. A system shall be in place to control simultaneous operations involving hazardous materials to avoid mixing of incompatible materials.
  14. Emergency response plans for incidents involving hazardous materials shall be in place and reviewed, tested and documented annually. These shall include external support services such as local ambulance and hospitals, as appropriate to the risk.
  15. A system shall be in place to control and monitor access to areas where hazardous materials are stored and handled. This shall also identify process areas where hazardous materials may be released under certain operational circumstances (e.g. vent opening during process upset, infrequent discharge points) and what restrictions are placed on access to those areas.
  16. A system shall be in place to authorise and control the training of appropriate personnel in normal transportation, storage, handling, use and disposal of, and emergency response procedures for, hazardous materials.
  17. A system shall be in place to monitor short and long-term exposure of personnel to hazardous materials, which have the potential for immediate or long-term harm. This system shall ensure that fatality potential is also addressed.

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18. The following procedures shall be in place to protect communities and the environment during the transport of hazardous materials:
- establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters
  - require that hazardous material transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for hazardous material management
  - Where required, a hazardous material manifest and supporting documentation shall be completed and shipped with the hazardous material. This documentation shall comply with local legislation.
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## 8 PEOPLE REQUIREMENTS

1. A person shall be assigned as the site Hazardous Materials Co-ordinator at those sites where hazardous materials are processed, stored and handled. This person shall be trained and competent to understand and evaluate the risks associated with a wide variety of substances, and be able to identify where additional expert advice can be sourced. The site Hazardous Materials Co-ordinator shall be responsible for assessing the hazardous properties and disposal requirements of materials used, monitoring the consumption and management of inventory, and providing an “as needed” service to supply, warehousing, operational and the Safety, Health, Environment and Community (SHEC) personnel
  2. The risk assessment process shall include people with appropriate expertise. Consideration should be given to the inclusion of external people (e.g. suppliers’ technical officers) in the risk assessment process.
  3. A competency-based training system shall be in place for operational, maintenance and emergency response roles involving hazardous materials. Use should be made of supplier expertise to supply this training, with annual refresher courses, if required.
  4. Behaviour-based observations shall include the operation of equipment and systems handling hazardous materials. Any need for additional specific retraining shall incorporate the results of these observations.
  5. All personnel shall be trained to understand the potentially hazardous effects on health of their working conditions and the materials handled.
  6. Regular appropriately staged emergency drills shall be held and lessons learnt shall be incorporated into the emergency response plan.
-

## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 3, AFRS 3 – Hazardous Materials Management Standard

AA GTG 3 : AFRG – Hazardous Materials Management Guideline

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 3 (T. Hanmer, January 2011).

# AFRS 4 – MOLTEN MATERIALS MANAGEMENT STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the handling and processing of molten materials.

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## 2 APPLICATION

This Standard applies to operational activities in and around furnaces and smelters, and includes hazards associated with the processes of tapping, casting, handling and transport of molten material and the operation of the smelting process and associated processes involving hot material. A risk-based approach should be adopted to decide the application of these requirements to other categories of hot materials (e.g. fertilizers, steam, gases, etc.). The additional requirements of the Hazardous Materials Management Standard also apply to materials covered by the Molten Materials Management Standard.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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## 3 DEFINITIONS

None

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## 4 REASON FOR INCLUSION

As molten materials have been involved in a number of fatalities at Anglo American businesses and operations, they require specialist management, equipment, processes and competencies over and above those applied to the handling of other hazardous materials. The causes of and factors contributing to these incidents have been;

- Inappropriate moisture levels;
  - Loss of control during ladle movement;
  - Water/metal contact;
  - Inadequate personnel access control;
  - Equipment failure due to heat;
  - Molten material breakout;
  - Inadequate design.
-

## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties,
2. Documented and detailed risk assessment of the situation under proposed alternative control measures,
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. The basis of design of molten materials facilities shall be reviewed, amended as necessary and documented utilising the HAZOP or other systematic hazard analysis processes. As-built design drawings (e.g. process and instrumentation diagrams, process flow diagrams, layout drawings, isometrics, software) shall be updated as a result of these reviews.
2. Design specifications for all new or modified facilities shall be subject to risk assessment and shall detail materials selection, storage, loading and unloading facilities, leading industry practices, applicable regulations and learnings from previous incidents.
3. All molten materials facilities shall provide for response to emergencies involving molten materials, including the provision for safe refuge and emergency response equipment for spillage containment, fires, explosions, burns, etc. and recovery and disposal of the molten material.
4. Alterations to the layout, risk control and mitigation equipment and systems shall be covered by the change management procedures.
5. Equipment associated with the handling and processing of molten materials shall incorporate fail-to-safe systems in the event of power failures, power dips and surges.
6. Automatic plant shutdown systems (local and remote to the hazard) shall be in place to eliminate the need for operator intervention to maintain operation within the design envelope.



7. Transport roads and rail systems for molten material carriers should, wherever possible, be dedicated for this purpose and clearly demarcated. Where this is not possible, risk analysis shall be undertaken to identify the additional controls required to manage the activities and potential conditions in the event of a molten material spillage or loss of vehicle control and other hazards associated with transport over non-dedicated routes.
8. Molten materials processing and handling areas shall have sufficient emergency exits to provide at least two means of egress from any point.
9. Water supplies to molten material areas shall be limited to dedicated systems (e.g. jacket cooling) and free access to water tapping points shall be eliminated, as far as practicable.
10. The tapping, decanting and casting processes should, wherever possible, be mechanised, automated and controlled from a remote location. Where this is not possible, risk analysis shall be undertaken to identify the additional controls required.
11. Restricted areas for handling and processing of molten materials shall be defined and demarcated, and compliance shall be managed using a system of access controls. Where this is not possible, risk analysis shall be undertaken to identify the additional controls required.
12. Restricted areas and areas directly exposed to molten materials processing and handling shall be safeguarded to prevent personnel coming into contact with molten material or hot surfaces. Risk analysis shall be undertaken to identify any additional controls required.
13. All surfaces in contact with molten materials shall be coated, prepared, or be of such a nature or grade that no exothermic reaction will occur when in contact with the molten material.
14. Molten materials processing and handling areas shall be designed to contain any spillage that may occur and shall provide for safe clean-up and disposal.
15. Molten materials processing and handling areas shall have general ventilation services, fume extraction facilities and emergency venting systems to minimise the exposure of people to dust, fumes and gases.
16. The driver or operator of molten material transporters shall be protected from radiated heat and from accidental spillage by means of a heat-resistant physical barrier.

## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

1. All molten materials processing and handling shall be subjected to risk assessment.
2. Procedures shall be in place for all molten materials processing, handling and safe disposal activities.
3. A system shall be in place to ensure that all process drawings and software are current and easily accessible by operational personnel.
4. Monitoring systems shall be in place to ensure that the status of operation is shown clearly at all times. These monitoring systems shall include the procedure for a documented hand-over to the next shift, recording any relevant information/ changes in operating status.
5. The safe operating envelope for molten materials shall be defined and understood by all process personnel. This shall include the indicators (physical, systems or observation-based) that demonstrate that the limits of safe operation are being approached or have been breached (e.g. indicators of moisture present in systems containing molten metal).

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6. Critical equipment shall be defined and maintenance plans for that equipment shall be documented.
  7. Emergency response plans shall be in place and, as a minimum, an annual simulation exercise shall be conducted. Specialist first aid and pre-hospitalisation trauma care for injuries shall be components of the emergency response services and shall be tested during simulation exercises.
  8. A procedure shall be in place to provide a quarantined store for alloys and other material to be recycled into systems containing molten materials so as to prevent explosions, contamination or other uncontrolled reactions.
  9. A procedure that has the approval of the local traffic authorities shall be in place for the vehicle transportation (other than rail) of any molten materials along or crossing public roads, over railway level crossings and past, or through, residential areas.
  10. The management of change process for any operation shall include specific steps to assess the impact of changes on the risk associated with molten materials.
- 

## 8 PEOPLE REQUIREMENTS

1. The roles and responsibilities for molten materials processing and handling shall be defined and assigned.
  2. A competency-based training system shall be implemented for operational and maintenance roles involving molten materials processing and handling.
  3. All personnel shall be trained in their duties and responsibilities under emergency conditions.
  4. All personnel shall be trained to understand the potentially hazardous effects on health of their working conditions and the materials handled.
  5. The use of effective personal protective equipment shall be monitored and enforced in all areas where this type of control is required.
  6. A fit-for-work policy shall be in place, incorporating the clearly-defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of drivers/operators, and a system shall be in place for fatigue management.
  7. Behaviour-based observations shall include the operation of equipment and systems handling molten materials. Any need for additional specific retraining shall incorporate the results of these observations.
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## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 4, AFRS 4 – Molten Materials Management Standard

AA GTG 4 : AFRG – Molten Materials Management Guideline

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 4 (T. Hanmer, January 2010).

# AFRS 5 – EQUIPMENT SAFEGUARDING STANDARD

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## 1 AIM

To eliminate the risk of fatalities and injuries where and when there is the potential for human interaction with moving parts or potential moving parts of plant and equipment.

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## 2 APPLICATION

This Standard applies to safeguarding of people from moving parts of plant, mobile machines, equipment and power tools, including moving equipment, high pressure equipment and applications, electrical and other energy sources with the potential to move, and objects falling or projecting from moving parts.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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## 3 DEFINITIONS

None

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## 4 REASON FOR INCLUSION

A number of high-potential and fatal incidents have been associated with inadequate and inappropriate safeguarding. The causes of and factors contributing to these incidents have been:

- Absent, damaged or inadequate guarding in place;
  - Working alongside unguarded moving parts;
  - No process to identify guarding needs;
  - Objects falling or projecting from moving parts;
  - Ineffective guarding standards in place;
  - Equipment mobilised by high-pressure equipment;
  - Working on moving parts with guarding removed;
  - Lack of guarding interlocks on potential high-risk plant and equipment;
  - Non-adherence to existing procedures;
  - Uncontrolled release of pressure (oil/water) and temperature.
-

## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
2. Documented and detailed risk assessment of the situation under proposed alternative control measures
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. New plant and equipment shall consider all energy sources and be designed to eliminate the need for guarding where practicable. Safeguarding shall be selected where other potential mitigation measures do not adequately protect personnel as identified in the risk assessment in line with Element 7 of this Standard.
2. Plant and equipment safeguards shall be designed and constructed to comply with relevant legislation, standards, codes of practice and relevant recognised leading industry practices, with due consideration for maintainability and operability.
3. A formal system shall be in place to ensure the integrity of plant and equipment safeguarding.
4. Where safeguarding and interlock systems are insufficient to protect people, access to plant and equipment shall be controlled and monitored.
5. Fail-to-safe switches or devices shall be installed on all manually-operated rotating plant and equipment and power hand tools (e.g. saws, lathes, drill presses, etc).
6. Guards shall only be removed for maintenance, repair, cleaning, clearing, etc. after plant and equipment have been isolated, locked out and tested in line with the Isolation Standard. Where the temporary removal of safeguards is necessary on operating plant and equipment for the purposes of fault-finding, testing and commissioning, a risk-based procedure shall be in place. Guards shall be replaced prior to plant and equipment being put back into operation.

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## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

7. A risk-based process shall be used to identify where safeguarding and interlocks are required on plant and equipment.
8. A risk-based process shall be used to identify safeguarding hazards that require interlock systems for additional control.
9. All documentation related to the risk-based process for the selection and modification of safeguarding requirements shall be retained and controlled.
10. A change management system shall be used to ensure the integrity of safeguarding is optimal when change occurs.
11. No guarding shall be modified or altered except through the application of a risk-based change management process.
12. Procedures shall be defined for entry to plant, equipment etc. in a designated safeguarded area.

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## 8 PEOPLE REQUIREMENTS

13. A competency based training system that includes the requirements of this Standard shall be in place for relevant personnel involved in the design, purchase, construction, operation and maintenance of plant and equipment.
  14. Behaviour-based observations shall include work activities associated with plant and equipment safeguarding. Any need for additional specific retraining shall incorporate the results of these observations.
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## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 5, AFRS 5 - Equipment Safeguarding Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 5 (Dr. J. Wannenburg, January 2011).

# AFRS 6 – ISOLATION STANDARD

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## 1 AIM

To ensure that all machinery and equipment is isolated, locked out and made safe (all energy released) prior to any access, work or repair being carried out, in order to protect the health and safety of persons.

## 2 APPLICATION

This Standard is applicable, but not limited to all sources of energy including potential kinetic, elastic, chemical, electrical, mechanical, thermal (e.g. hot liquids, solids, gases), nuclear, static, rotational, out of balance, light and gravitational. Energy associated with processes such as materials handling, transport, pressure, vacuum, hydraulic, pneumatic and chemical processes, are also included. Moving and stationary machinery is included. This Standard stipulates the minimum requirements to which the isolation, lock-out and making safe procedures must comply.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

## 3 DEFINITIONS

Authorised Person	: A competent person tested and appointed in writing by the responsible supervisor to do specific operations (i.e. operating electrical switchgear).
Responsible Supervisor	: The manager/engineer in charge of the Operations as per legal definitions or internal regulations.
Operator	: The person in charge of the operation of some specific equipment or machinery.
De-Energise	: To remove effectively all possible sources of energy from the item, system, process, area or equipment in question.
Earthed	: Connected to the general mass of earth in such a manner that will ensure at all times an immediate discharge of electrical energy without danger.
Isolation	: To physically remove any connection or means to supply any form of energy to equipment in order to make energisation of such equipment impossible.
Lock Out	: to put a personal lock or appropriate device on to equipment in such a way that it would be impossible to connect, switch on or start, utilise or energise the equipment without removing the lock or device.
Make Safe	: to remove any threat or potential threat to health and safety posed by the source of energy, equipment, any equipment in the vicinity, any other substance or charge in the immediate area. This includes, but is not limited to, barricading, clamping, chocking, constraining, deflating, earthing, neutralising, purging and ventilating.

Permit-To-Work : a form of written declaration signed and given by the person legally responsible for the Plant to the person in charge of work to be carried out on machinery or equipment that has been isolated, locked out and made safe.

## 4 REASON FOR INCLUSION

A significant proportion of our potential fatalities have included cases where sources of energy were not isolated adequately. The causes of and factors contributing to these incidents have been:

- Failure to identify or recognise a source of potential or stored energy;
- Inadequate training or lack of competence;
- Inadequate lock-out/tag-out systems;
- Complacency;
- Working on, or isolation of, the wrong equipment;
- Inadequate design/maintenance of isolators.

## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
2. Documented and detailed risk assessment of the situation under proposed alternative control measures
3. Documented formal approval from the divisional head of safety and the divisional chief executive officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American group vision of zero harm.

## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. All equipment whether purchased or constructed (including hired and contracted equipment), shall have the capability of being isolated physically from all energy sources and shall meet the requirements of this Standard.
2. Isolation shall provide positive protection against harm and shall be achieved by the use of locking devices or the establishment of a physical barrier or separation.
3. Personal locking devices shall be unique and:
  - not be combination locks,
  - not have an unauthorised second-party master override key,
  - be kept under the exclusive control of the owning individual, and key(s) shall not be transferred to another person for lock removal
4. Designated isolation points shall be labelled clearly to identify the circuit or system being isolated or locked out. These labels shall be applied following a process of pre-isolation identification using the lock-out procedure. -
5. All designated isolation points fitted with personal locking devices shall be tagged. The isolation tagging system shall ensure that:
  - isolation points are identified positively, including the name of the person locking out,
  - the reason for the isolation is identified clearly,
  - isolation tags are highly visible to prevent inadvertent operation

## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

6. An isolation, lock-out and making safe procedure shall be in place to ensure correct isolation and that all equipment is made safe prior to gaining access or commencing any operation, cleaning, maintenance or repair work requiring access to parts of a machine or removal of a guard or interlock. The procedures shall define clearly the responsibilities of all parties involved.
7. The lock-out procedure shall include the following:
  - Visible indication of isolation,
  - Clear identification of the machinery or equipment to be locked out by the operator,
  - Formal hand-over of the control of the equipment from the operator to the authorised person,
  - Duties and responsibilities of both the operator and the authorised person,
  - Sequence of events to be followed during the procedure,
  - Formal hand-over of the control of the equipment back from the authorised person to the operator,
  - As determined by risk assessment, isolation of high-energy sources or other high-risk work requires a “permit to work”. When permits are required, the authorised person must isolate, test for dead and earth the equipment before issuing a “permit” to the person responsible for the work. This person then completes the lock-out according to the applicable procedure,

- A list of site-specific procedures for which a “permit to work” is required should be approved and communicated by the responsible supervisor.
8. The lock-out procedure shall begin with a risk assessment to ensure that work is undertaken safely.
  9. All parties involved shall identify the equipment before the authorised person de-energises isolates or locks out equipment. All parties involved shall ensure that the equipment cannot be energised or operated inadvertently. There shall be provision for multiple locks, if required. Each person working on the equipment shall apply his own personal lock to prevent the isolation being removed.
  10. Once equipment has been isolated and locked out, it shall be the responsibility of the authorised person to safely test that the equipment is made safe (all energy is discharged). The type of test shall depend on the equipment but, in all cases, all energy shall be discharged or controlled. This test shall be described in the lock-out procedure. Only instruments approved for this purpose shall be used for these tests. The tests shall include, but not be limited to:
    - Pressure,
    - Voltage, including induced voltage,
    - Redundant charges,
    - Elevated equipment,
    - Enclosed areas,
    - Hazardous chemicals (particularly in confined spaces),
    - Stored electrical energy,
    - Temperature,
    - Equipment under tension (e.g. conveyor belt),
    - Equipment requiring regular operator access (e.g. chutes, screens)
    - Sources of gas,
    - Mobile equipment.
  11. All machinery or equipment that can cause harm in the immediate area shall also be made safe.
  12. Confirmation of isolation, lock-out, appropriate testing and making safe shall be recorded and signed for by all affected parties.
  13. A warning sign, stating that specific machinery has been de-energised because work is in progress, shall be posted at the points of isolation.
  14. Only after all these procedures (Elements 7-13) have been adhered to, shall work commence on the equipment.
  15. After completion of the work, a hand-over procedure back to the operator shall be in place.
  16. For audit trail and risk management, the responsible supervisor shall, on a regular basis:
    - Re-assess the competence of the authorised persons,
    - Audit the lock-out records and “permit to work” documents,

- 
- Undertake a risk assessment on the lock-out procedure,
  - Undertake planned task observations.
17. All safety incidents, including near hits, shall be reported, investigated and analysed. Corrective and preventative actions shall be taken and closed out and the learnings shared as per the ANGLO SAFETY WAY.
- 

## 8 PEOPLE REQUIREMENTS

18. The person in charge of the operation of the equipment shall be clearly identified and this shall be recorded. This person shall be identified as the operator for the purposes of this Standard.
19. All individuals issued with personal locking devices shall be provided with training and have their competence assessed on a regular basis.
20. The responsible supervisor is the person appointed in terms of applicable legislation or internal regulations. The responsible supervisor shall:
- ensure that all lock-out operations are carried out in terms of the lock-out procedure
  - authorise suitably competent persons in accordance with requirements
  - ensure and record that all authorised persons remain competent (by means of observation audits and re-training) to carry out their duties
  - ensure that the lock-out procedure remains current and that it is updated when necessary (e.g. annually) to provide for equipment and/or process modifications
  - ensure that the lock-out procedure is adhered to continually by conducting verification exercises such as planned task observations
21. The authorised person shall be responsible for the safe execution of isolation and lock-out duties as per the lock-out procedure (Element 7).
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## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 6, AFRS 6 – Isolation Standard

AA GTG 6 : AFRG 6 – Isolation Guideline

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 6 (H. Coetzee, January 2011).



# AFRS 7 – WORKING AT HEIGHTS STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from working at heights.

## 2 APPLICATION

This Standard applies wherever there is potential for any person to fall 2 metres or more, or to gain access to within 2 metres of an open edge from where there is the potential to fall 2 metres or more, including working from various forms of portable and moveable elevated work platforms, cages, ladders, scaffolding and where objects could fall and cause injuries. Risk assessment may identify high potential fall hazards when working at heights of less than 2 metres, in which case this Standard shall be applied. (Note: if local legislation requires more stringent controls, then those controls shall be implemented.) This Standard does not apply to rope rescue situations and abseiling, which are regarded as specialist functions.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

## 3 DEFINITIONS

Barricading	: A physical barrier that prevents inadvertent access to an area (e.g. handrails, access doors and gates or similar installations, whether temporary or permanent). Barrier tape does not qualify as barricading.
Demarcation	: Any method that indicates that an area is used for a specific purpose or that access is restricted (e.g. barrier tape, painted lines on floor surfaces, portable signs denoting drop zones or no access past a specific point).
Fall arrest system	: The use of multiple, approved safety equipment components such as body harnesses, lanyards, deceleration devices, droplines, horizontal and/or vertical lifelines and anchorages, interconnected and rigged to arrest a free fall.
Fall prevention	: The design and use of a fall prevention system which ensures no exposure to an elevated fall hazard. This may require more than one fall prevention system or a combination of prevention or protection measures.
Fall restraint	: An approved device and any necessary components that function together to restrain a person in order to prevent that person from falling to a lower level.
Fixed lanyard	: A line used as part of a lanyard assembly to connect a harness to an anchorage point or a static line in situations where there is risk of a fall.
Inertia reel	: (Also known as a self-retracting lanyard or fall-arrest block) is a mechanical device that arrests a fall by locking onto a drop line and, at the same time, allows freedom of movement.

Suspension trauma : The effect that can occur when a person hangs for a prolonged period in fall-arrest equipment. The restriction of blood flow, especially from the legs, can cause serious cardiovascular problems within five minutes and become fatal shortly thereafter.

## 4 REASON FOR INCLUSION

Falls from heights have contributed to a significant proportion of our fatal and high-potential incidents. The causes of and factors contributing to these incidents have been:

- Lack of job planning and job assessment, including inspection of working areas;
- Failing to wear a harness;
- Wearing the wrong sort of harness;
- The use of a damaged harness;
- Wearing the harness incorrectly;
- Wearing a harness but not attaching the lanyard or fall restraint to an anchor point, or attaching it to an unsuitable anchor point;
- Unstable set-up of elevated work platforms;
- Degeneration of elevated platforms (e.g. corrosion);
- Inadequately-guarded or unbarricaded hole, edges, voids, excavations or walkways;
- Unsafe planking and scaffolding

## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
2. Documented and detailed risk assessment of the situation under proposed alternative control measures
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. All equipment for working at heights shall comply with, and be used in accordance with, relevant approved design standards and manufacturer's specifications.
2. Single person anchor points shall be capable of withstanding 15kN (approximately 3,372lbf). Where it is not practicable to install dedicated anchor points (i.e. ad hoc work), anchor points capable of withstanding 15kN shall be identified through a risk assessment process and shall be approved by a competent person prior to commencement of work.
3. Where personnel are required to work within 2 metres of an opening where they could fall, they shall use personal fall restraint equipment, such as a fixed lanyard and harness as a minimum, which will prevent them from falling over the edge.
4. Where there is potential to fall more than 2 metres, personnel shall wear appropriate personal fall arrest equipment. In such circumstances, the use of a full body harness, including shock-absorbing lanyard or inertia reel is mandatory. The use of body belts for fall arrest is prohibited, except for specialised tasks such as pole-climbing belts worn by specially-trained linesmen.
5. All forms of portable and movable elevated work platforms and suspended work cages shall conform to relevant approved design standards. People in the work platform basket shall each wear a correctly-fitted harness attached by a lanyard to a suitable anchor point. This does not apply to people working within a properly-constructed and certificated scaffold or other structure at height with the requisite handrails and toe boards.
6. Where there is potential to fall more than 2 metres in unprotected areas, access shall be restricted and controlled through risk assessment (e.g. stockpile feeder chutes, highwalls, water hazards, wharves etc.).
7. Where operators need to gain access regularly to places at height on large plant and mobile machinery (e.g. to clean windscreens or filters), then access ways should be provided. Ideally, these access ways should have handrails. Where handrails cannot be installed, then fall restraint or fall arrest equipment should be considered, dependent on the outcome of a risk assessment of each situation.

## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

8. The risk of fall shall be eliminated where reasonably practicable utilising the Hierarchy of Controls.
9. Standard work procedures shall be in place for the correct wearing and use of personal fall arrest and fall restraint equipment.
10. There shall be a “permit to work” system in place to control all non-routine working at heights not covered by written procedures.
11. A documented risk assessment shall be conducted before the commencement of working at heights and at any time the scope of work changes or the risk of a fall increases. The risk assessments shall include:
  - Consideration for the potential of objects, as well as personnel, to fall;
  - Selection of appropriate control measures using the hierarchy of controls;
  - The possibility for weather and other environmental conditions to influence the working conditions (e.g. wind, rain, snow, dust, gases, poor lighting, temperature, etc.);
  - Selection of appropriate equipment;
  - Selection of anchor and tie-off points;
  - Condition of supporting structures such as roofs;
  - Selection of appropriate barricading and/or demarcation;
  - Fall clearances i.e. length of lanyard + tear-out distance + height of user + safety margin.
12. All platforms, scaffolds and any other temporary structures shall be constructed only under the direction of competent and authorised persons.
13. All equipment shall be fit-for-purpose and undergo pre-use checks and a minimum of six-monthly (bi-annual) documented inspections by a competent authorised person. An equipment register and tagging system shall be in place to indicate compliance with this inspection. Testing shall be done in accordance with recognised standards.
14. Where the work method requires persons to detach and re-attach at height, a dual lanyard system shall be utilised to ensure that at least one connection point is maintained at all times.
15. Where the use of personal fall arrest equipment is required, a person shall not work alone.
16. Persons working at height shall ensure that their safety helmets are secured by using a helmet chinstrap to retain the helmet on the head.
17. A system should be in place to prevent tools, materials and other objects from falling from height.
18. Barricading and warning signage should be placed on all lower levels where personnel or objects may fall.
19. Personnel operating elevated work platforms and cages shall be trained and certificated for the specific equipment they are using.
20. Emergency response plan/s should be available for the rapid retrieval of personnel in the event of a fall from height as response time is critical if a person is to avoid suspension trauma.

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## 8 PEOPLE REQUIREMENTS

21. Sites shall provide for systems to ensure selected personnel are fit to work at heights. Specific attention shall be given to potential risk factors (e.g. personnel who suffer medical conditions, such as vertigo and epilepsy, and personnel who are overweight). Note: many harness systems have a maximum weight limit of 136kg/300lbs.
  22. A competency-based training programme, which includes provisions for maintaining competence, shall be in place for employees and supervisors. All persons engaged in work covered by this Standard shall receive appropriate training and be assessed for competence.
  23. Behaviour-based observations shall include activities and tasks associated with working at heights. Any need for additional specific retraining shall incorporate the results of these observations.
-

## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 7, AFRS 7 – Working at Heights Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 7(Dr. G. Krige, January 2011).

AA GTS 8	AFRS 8 – LIFTING OPERATIONS STANDARD	ISSUE 0 24 January 2011
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# AFRS 8 – LIFTING OPERATIONS STANDARD

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## 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the performance of lifting operations.

## 2 APPLICATION

This Standard applies wherever lifting operations are undertaken. It includes lifts involving Anglo American owned, hired or contracted cranes and lifting machines such as mobile, crawler, tower, derrick, portal and pedestal-type equipment (e.g. cherry pickers), vehicle loading cranes, electric overhead travelling cranes, hoisting blocks/tackle and monorail cranes. The Standard also applies to lifting equipment including slings, chains, wire ropes, shackles, pad-eyes, containers, baskets, tuggers, winches, man-riding winches, jacks, work-belts, harnesses and transfer baskets for equipment and personnel.

In addition to the manufacturer's standard safety features, local statutory requirements or, in the absence of these, ISO Standards, the minimum safety features indicated in this Standard shall or should be included.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

## 3 DEFINITIONS

Competent person	: A person who has the right training and experience to be regarded as competent under relevant legislation and/or internal regulations.
External rated capacity lighting	: Clearly-visible green, amber and red lights mounted externally to the crane: green to indicate safe operating range, amber when approaching maximum rated capacity and red when maximum rated capacity has been exceeded.
Lifting crew	: Persons working directly with a crane operation.
Lifting equipment	: Any device which is used or designed to be used directly or indirectly to connect a load to a crane and which does not form part of a load (e.g. wire rope slings, chain slings, man-made fibre slings, hooks and fittings, swivels, shackles, eye bolts, rigging screws, wedge sockets, plate clamps and lifting beams).
Lifting operations	: Any operation using a crane and lifting equipment that involves the raising and lowering of a load, including the suspension of a load.
Workbasket	: A personnel-carrying device designed to be suspended from a crane or other lifting machine.

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## 4 REASON FOR INCLUSION

A significant proportion of our fatal and significant incidents have occurred in the course of lifting and crane operations. Identified causes and contributing factors include:

- Lack of job planning and hazard assessment;
- Incorrect selection of cranes and lifting equipment for the task;
- Inadequate knowledge of lifting operations by personnel involved;
- Inadequate inspection, maintenance, tagging and storage of cranes and lifting equipment;
- Lack of training in correct use of lifting equipment;
- Lack of competence in lifting operations;
- Incorrect use of cranes and lifting equipment, including poor practices such as out-of-vertical loading and over-loading;
- Poor recognition of unsafe conditions, including environmental conditions;
- Operation of cranes and lifting equipment with safety and warning devices overridden, inoperable or illegible;
- Incorrect design of cranes and lifting equipment.

---

## 5 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
  2. Documented and detailed risk assessment of the situation under proposed alternative control measures
  3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of zero harm.
-

## 6 PLANT AND EQUIPMENT REQUIREMENTS

1. All electrical cranes shall have power supply isolation points capable of being positively locked out and isolated.
2. Cranes shall have their operability assessed against site conditions and workforce (e.g. language for the controls) and have fall protection systems provided for people in charge of their operation, maintenance and inspection.
3. Cranes shall not be used without a physical locking system that disables and isolates their free-fall capability.
4. Electric overhead travelling and portal cranes should have overload protection.
5. Crane cabins should be air-conditioned or heated in accordance with environmental conditions.
6. All crane cabins shall have signs to warn against interruption of the operator.
7. Vehicle loading cranes shall have sufficient engineering controls to prevent the operator from being crushed during lifting operations.
8. All crane hooks shall be fitted with a positive locking safety catch.
9. The Safe Working Load (SWL) shall be clearly identified and marked on all cranes and relevant lifting equipment and shall not be exceeded.
10. For cranes, the following should be made available:
  - Load cells;
  - Load moment indicators;
  - External rated capacity lighting;
  - Stability monitoring devices (to prevent overturning).
11. All cranes and lifting equipment shall comply with the requirements of the relevant approved design standard. The minimum acceptable design standard shall be the relevant ISO Standard. In countries where the requirements of the relevant national standard exceed the requirements of the ISO Standard, the national standard shall apply.
12. All cranes and lifting equipment shall be identifiable with a unique identity code and its rated capacity should be visibly displayed.
13. A competent person shall determine the maximum environmental conditions under which cranes and lifting equipment can be used safely. Except in the event of an emergency, cranes and lifting equipment shall not be put into service if the maximum environmental conditions are exceeded. Risks shall be assessed in emergency situations.
14. Items of lifting equipment that are subject to wear and frequent replacement (e.g. slings, shackles, pad-eyes, shipping and handling baskets) or are used to transport equipment to and from sites shall be colour-coded to confirm compliance with inspection requirements.
15. Lifting by the use of a block and tackle, for example, shall only be done from designated lifting points or be authorized by a competent person.
16. All lifting equipment shall be maintained in good condition with inspection maintenance log books. Proof-loading shall be undertaken as appropriate.

## 7 SYSTEM AND PROCEDURAL REQUIREMENTS

17. A formal selection and acceptance process based on risk assessment shall be in place for all new (to site) and modified lifting equipment, taking into account the crane's various safety features and cabin ergonomics, prior to commencement of work.
  18. Manufacturer's crane and lifting equipment operating instructions and load charts shall be available to the crane and lifting equipment operator. These should be in the language of the country in which the lifting equipment is being used.
  19. Where crane and lifting equipment operators are not conversant with the language of the country, provisions shall be made to ensure that the operators can understand the operating manuals and load charts.
  20. A procedure shall be in place to address:
    - That the load and reach do not exceed the capacity of the lifting equipment;
    - Lifting operations when the arcs of operation of two or more cranes can overlap\*
    - Stationary multiple crane lifting operations\*;
    - That "pickup and carry" operations using multiple mobile cranes is prevented;
    - The danger to lifting operations when adverse weather conditions are present or imminent (e.g. electrical storm, high winds and sea state);
    - The safety of personnel when cranes and lifting equipment are operating in the proximity of live electrical conductors\*;
    - Lifting operations when lifting near or over unprotected plant, equipment or services, including live process or hydrocarbon processes\*;
    - The effective hand-over, from one operator to another, of cranes with complex boom, jib or tower configurations;
    - Availability and use of check-lists for pre- and post-operational inspections.
- \* Detailed lifting plans are required for these procedures and shall be approved by a competent supervisor. Co-ordination meetings shall be held prior to such lifts to ensure all personnel understand how they are to be executed.
21. Cranes shall not be used for lifting operations until crane operators have been given sufficient time to familiarise themselves with relevant aspects of the crane.
  22. Risks associated with all lifting, crane maintenance, assembly activities and environmental conditions shall be assessed as part of the planning process. Barricading, warning signs or other means of ensuring personnel protection shall be in place during lifting operations and for those cranes left unattended in wind vane mode.
  23. Side loading of crane booms should be prevented according to the manufacturer's specifications.
  24. With the exception of pick and carry operations, no lifting shall be carried out without outriggers being deployed and locked.
  25. Controls shall be in place to prevent the falling of objects from lifting equipment and suspended loads.
  26. The lifting of personnel with cranes shall be carried out only with the use of approved workbaskets or cages. Cranes used for this purpose shall be approved as suitable for man-lifting operations. A recovery plan should be in place before personnel are lifted.

27. The elimination of the need to work under or in the drop zone of suspended loads shall be pursued. Where working under suspended loads is unavoidable, controls shall be in place to eliminate or minimise the risks to personnel.
28. Any modification to cranes and lifting equipment shall be subjected to the original equipment manufacturer's approval and to a rigorous change management process.
29. A preventative maintenance system should be in place to ensure that all cranes and lifting equipment are maintained and in a serviceable condition, with appropriate records being kept.
30. All cranes and lifting equipment shall be inspected and tested to ensure all safety devices are working (including non-destructive testing as required by the relevant standard) prior to being operated or put into service. After any repair and/or modification, cranes and lifting equipment shall be inspected (and non-destructively tested as required by the relevant standard) prior to being returned to service.
31. A system of periodic inspection shall be in place for all cranes and lifting equipment. Lifting equipment shall be inspected visually and confirmed fit for purpose prior to being put into service. Visual inspection of lifting equipment by an approved competent person shall be performed on a regular basis (e.g. six monthly) unless regulations in the local area require examination more frequently.
32. A register of all lifting equipment (including slings) should be maintained. This should include:
  - Equipment's unique identification number;
  - Documentary evidence of all inspections;
  - Certifications;
  - Maintenance;
  - Modifications and tests.

## 8 PEOPLE REQUIREMENTS

33. Suitably qualified, certified and competent person/s shall be involved in the planning, supervision and implementation of the lifting operations.
34. The roles and responsibilities of personnel engaged in lifting operations shall be defined clearly.
35. A competency-based training programme for contractors, employees and supervisors shall be in place. An approved examiner should assess the competence of trainers performing such training.
36. A competent inspector shall perform inspections of cranes, lifting machines and lifting equipment. An approved examiner shall assess the competence of the lifting and handling equipment inspector.
37. Crane operators and crew shall be able to communicate in a common language and to use the correct crane signals.
38. Sole crane operators shall be trained in slinging practices.

- 
39. A fit-for-work policy shall be in place, incorporating the clearly- defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of drivers/operators, and a system shall be in place for fatigue management.
  40. Behaviour-based observations shall be performed and any need for additional specific training shall incorporate the results of these observations.
-

## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 8, AFRS 8 - Lifting Operations Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 8 (Dr. G. Krige, January 2011).

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# AFRS 9 – UNDERGROUND STABILITY AND OPTIMISATION STANDARD

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## 1 AIM

This Group Technical Standard defines the minimum requirements for underground ground stability and design optimisation at Anglo American.

To eliminate or minimise the risk of fatalities, injuries and incidents resulting from falls of ground and collapse in underground operations and manage the associated risks to a level that is as low as reasonably practicable (ALARP) whilst safely maximising the value at Operations.

## 2 MOTIVATION

Technical Governance is a vital component of Group Governance processes. It is intended to be the cornerstone to achieving global leading business performance by adding value and mitigating risks across the organisation. Concise, non-negotiable Policies and Standards are supported by Guidelines on major technical issues and opportunities where a common and consistent approach should be taken across Anglo American.

This Group Technical Standard shall define the organisation, systems and processes to support the Technical Governance process and ensure it is applied consistently.

A significant proportion of fatalities and potentially fatal events in underground mines are connected with falls of ground. Added to this is the loss of production, damage to equipment and infrastructure, additional operating costs and loss of revenue. Apart from safety benefits, appropriate management of this risk can potentially result in significant value-add in terms of excavation and ground support design.

The implementation of this Standard will set the minimum requirements to manage and mitigate the causes and factors contributing to falls of ground.

## 3 APPLICATION

This Group Technical Standard is mandatory and applies to the Anglo American corporate centre and all managed businesses and operations, including contractors and visitors when involved in controlled activities. This Standard is authorised by the Group Technical Standards Board.

This Standard applies to all underground ground control planning and activities, and will ensure unambiguous application and implementation of sound and leading ground control practice in order to preserve and enhance value through optimal, safe underground mining activities.

An unexpected rockfall or fall of ground (FoG) incident occurs due to instabilities in the rock mass and associated failure to identify and manage such instability. The common causes of such FoGs include:

- a) Inadequate/incorrectly installed support
- b) Inadequate operational control and monitoring, including ground displacement and stress monitoring
- c) Inadequate response to changing ground conditions

- d) Unexpected adverse geological conditions
- e) The integrity of the excavation being compromised due to natural events
- f) Inadequate excavation and/or ground support design

Proper management of the above basic sources is critical in mitigating the risks posed by ground instability, and forms the basis from which a risk assessment shall be done for all underground excavations. This risk assessment is the basis for the ground control activities and strategies, and shall be recorded in a Ground Control Plan (GCP).

## 4 DEFINITIONS

ALARP : As low as reasonably practicable.

Competent person : A person with specific graduate training in rock/geotechnical engineering or a government certificated equivalent, with suitable experience in the field of application/operation.

Code of Practice : In the context of the South African legal requirement, the Ground Control Plan is equivalent to the Code of Practice.

Excavation : A planned and designed manmade hole in the earth or a face of earth formed for the purpose of exploiting a mineral resource and is either in use or scheduled to be used/re-used. It is distinguished from a surface excavation in that the underground excavation has a roof/hangingwall immediately above it.

Fault tree analysis : Identifies, quantifies and represents in diagrammatic form the faults or failures, and combinations of faults or failures, which can lead to a major hazard exposure or event.

Fall of Ground (FoG) : An uncontrolled fall of rock that has the potential to hurt a person, damage equipment or incur a business cost, excluding rolling rocks. Rocks caught in safety nets shall still be classified as FoG.

Geotechnical Hazard Management Plan : A management plan developed by the on-site geotechnical function in which geotechnical hazards are identified, ranked and mitigation specified.

Geotechnical Hazard Plan : A physical plan developed by the on-site geotechnical function in which areas and levels of geotechnical risk are specified. This Plan shall show areas of potential instability, rockfall hazard and other geotechnical hazards such as groundwater, poor ground conditions and structural complexity. This serves to convey geotechnical hazard information to mining supervisors as a useful means of communicating geotechnical hazards to all mine personnel and shall be posted where relevant personnel can easily reference it.

**Ground Control Plan (GCP)** : A site specific geotechnical management plan based on corporate risk acceptance guidelines, local (site specific) ground conditions and local regulatory requirements, to address the identified Geotechnical hazards. The GCP must define and document the geotechnical and related controls, processes and monitoring for the mine site and all related responsibilities and accountabilities. This shall cover both operational and functional requirements across the entire mining process and for all relevant disciplines. It is produced at the completion of the planning and design phase, and forms the basis for design implementation and geotechnical risk management. The most senior legally responsible operational person on site is accountable for the GCP, once ratified by the competent person as described in Section 4.

**Group Technical Guideline** : Group Technical Standards normally have an associated Group Technical Guideline. In some cases these may be public domain documents.

Group Technical Guidelines shall expand on requirements set in the Group Technical Standards, providing more detail including generic documentation, interpretations, examples of leading practice and dealing with implementation aspects.

A basis for producing Procedures, Work Instructions, Forms and Templates.

**Group Technical Standard** : Group Technical Standards define minimum requirements to be implemented across the Anglo American Group. They are driven by risk or value-based criteria or are needed to enable governance where a common and consistent approach should be taken across the Group.

**Hazard** : A source of potential harm to people, facilities, the environment or the community, identified by looking at potential or stored energy that could result in an unwanted incident if released.

**Multi-tiered Ground Support Response Plan** : A set of rules that provide guidance on support requirements and other actions needed based on visual or monitored ground behaviour trigger points (also known as Trigger Action Plan, Strata Control Action Response Plan or Hazard Identification and Treatment Systems).

**Risk** : A combination of the likelihood of an occurrence of a hazardous event or exposure and the severity of injury, illness and/ or impact that may be caused by the event or exposure.

Risk analysis	:	The systematic process to understand the nature of and quantify the level of risk.
Risk assessment	:	The overall process of risk identification, risk analysis, evaluation of risk and risk mitigation.
Risk management	:	The systematic approach to managing an established risk within a particular situation. This includes hazard identification, risk analysis, risk evaluation, determining whether the risks are acceptable and the ongoing treatment of risks through the application of management policies, processes and procedures.
Rockburst	:	A seismic event that causes damage to underground workings or a sudden and violent rock failure around a mining excavation on a sufficiently large scale to be considered a hazard.
Rockfall	:	An uncontrolled fall of rock from the roof/hangingwall, ribside/sidewall or the face without the simultaneous occurrence of a seismic event. Usually gravitationally induced, although there may be many contributing factors, e.g. blasting, with the potential to cause injury or damage.
Secure ground	:	Ground that is supported in accordance with the GCP or ground which has been assessed by a competent person, as defined in Section 4, as not requiring support or requiring minimum support in accordance with the GCP. It also refers to ground that has been temporarily supported, in accordance with the GCP, for the purpose of installing permanent support.
Seismic event	:	The transient earth motion caused by a sudden release of the strain energy stored in the rock.
Self-auditing	:	Applies to ground support units which have an in-built indicator that automatically indicates when the support unit has been correctly tensioned, e.g. shear-pins that snap off when correct tension is applied during installation.
Variable Risk Management Model	:	A model that recognises that risks change over time, by location and/or operation. Risk controls are adjusted as the risks increase or decrease, allowing optimisation of designs and risk management controls.

## 5 REQUIREMENTS

Excavation and support design are major controlling parameters in the determination of the Net Present Value (NPV) of an underground mining operation. Effective design seeks to maximise the economic value of the mining operation while managing the associated fall of ground and/or rockfall risks to a level in which there is confidence in the ability to prevent unwanted incidents (this forms the basis of ALARP). This requires sufficient data quality, quantity and integrity as well as a detailed design analysis, technical and mining professional competency, monitoring and an adequate review process.

Every underground excavation shall have a fall of ground and/or rockfall risk assessment, which shall be used to guide the level of risk management implemented, using a Variable Risk Management Model. A Variable Risk Management Model recognises that the appropriately calculated base line risk/s change with time, location and/or operation, and that the appropriate controls have been implemented as prescribed in this Standard. Successful use of the Variable Risk Management Model is wholly dependant on the timely identification of a change in the risk level/s and triggering the appropriate actions to ensure safe and optimum extraction of reserves. The risk assessment shall be carried out by a multi-disciplinary team consisting of at least a Geotechnical/Rock Engineer, Geologist and the Mining Engineer responsible for that area/working place. The cycle of re-doing the risk assessment shall be determined by risk exposure, the intended life and criticality of the excavation, any changes identified in the prevailing ground conditions and any applicable legal requirements.

This risk assessment shall be used to establish the basic design parameters and risk control measures required to reduce the risk to an acceptable level, ALARP. The design shall also take into account the life and/or criticality of the excavation when determining an acceptable probability of failure. This level of risk is currently generically set at a 1:10 000 probability of a fatality.

### 5.1 People

The most senior manager of the operation shall authorise the GCP and shall be accountable for its implementation and on-going effectiveness in accordance with this Standard and with local regulations.

All mines shall have access to a competent person, as defined in Section 4, who has relevant understanding of the prevailing geological and mining conditions at the specific mine.

Specific operational and technical roles and responsibilities shall be assigned to ensure implementation and management of the GCP.

A competency-based training programme shall be in place and shall be cascaded to all underground operating personnel. The training programme shall include, but not be limited to, the following:

- a) Identification of geological anomalies which contribute to weaker ground conditions
- b) Support design principles
- c) The content and requirements of the GCP as is applicable to them

- d) Placement and removal of support units – temporary and permanent support
- e) Recognition of indicators of change that may affect ground stability (aligned with Multi-tiered Ground Support Plan and associated triggers)
- f) On-the-job training and assessment
- g) Requirements for reporting changes
- h) Barring and scaling

Sufficient, suitably qualified, competent and experienced person/s shall be involved in the integrated risk management process of design, planning and implementation of the Ground Control and Mining Plan.

A process shall be developed and maintained for on-going communication between the Rock Engineering/Geotechnical staff, Operations Management and Operators.

Shift change procedures shall include the requirement to document and notify relevant personnel of changes to ground conditions and control.

Behaviour-based observations shall include work and tasks associated with ground control systems. Any need for additional specific retraining shall incorporate the results of these observations.

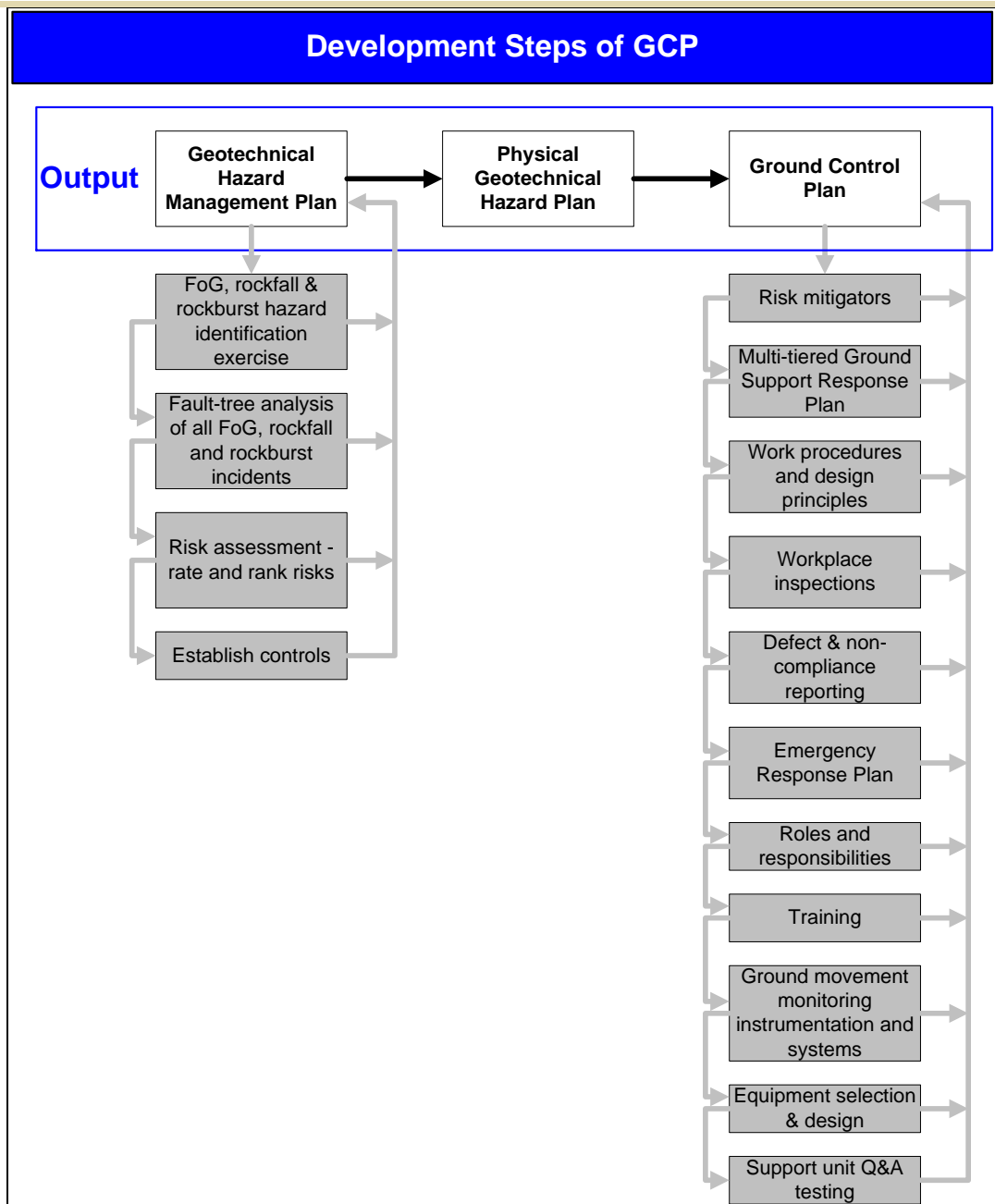
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## 5.2 Systems

A site based underground GCP shall be developed for all underground mines. The GCP shall be reviewed and approved by a competent person, as defined in Section 4, and signed off by the most senior manager of the operation. The GCP shall be reviewed and updated at least every three years, when a relevant high potential incident occurs, when mining into any new areas or areas of previously unknown ground conditions, as appropriate technological advances take place or as required by local legislation. Such a review shall also be done following an injury or damage to equipment from a FoG/rockburst having any dimension exceeding the standard support spacing.

The GCP is a management plan that details the mitigation of risks associated with ground control, prevailing geological and mining conditions and the resultant ground support requirements. The development steps of the GCP are illustrated in Figure 1 below.

---



**Figure 1 Development steps of the Ground Control Plan**

The steps in developing a GCP are as follows (illustrated in Figure 1):

- a) A Geotechnical Hazard Management Plan or Ground Control Hazard Plan shall be drawn up by;
1. Conducting a fall of ground/rockfall hazard identification exercise.
  2. Conducting a fault-tree analysis of fall of ground/rockfall hazards and incidents to gain a better understanding of the root-causes of these hazards and incidents.
  3. Followed by a risk assessment to rate/rank the identified risks in the fault-tree analysis.



4. Establish the controls required to mitigate the risks.
  5. A physical Geotechnical Hazard Plan (different to the Geotechnical Hazard Management Plan) shall be drawn up clearly identifying and ranking areas regarded as having the potential for fall of ground/rockfall incidents. This Plan shall be used in the operation planning and support design activities. This Geotechnical Hazard Plan shall be kept up-to-date through the systematic collection and analysis of data, which allows for the management of prevailing and predicted conditions and assists with pre-empting changes to the physical conditions. Such information shall be communicated to all relevant personnel in advance of any change.
  6. The Geotechnical Hazard Plan shall be updated when new information is collected and the changes shall be communicated to all relevant personnel and displayed at appropriate places for easy reference by the relevant personnel.
- b) The GCP shall then be developed to stipulate how these risks will be mitigated and what controls will be implemented.
  - c) Roles and responsibilities shall be assigned in the GCP, including those of the operational (underground) personnel and management.
  - d) Every underground employee shall be trained on the requirements of the GCP as applicable to them.
  - e) A Multi-tiered Ground Support Response Plan or Trigger Action Response Plan shall form part of the GCP, clearly outlining appropriate action to be taken to any adverse ground condition or change in ground condition.
  - f) Each Business Unit shall define its own Work Procedures and Design Principles for all routine and non-routine excavations. This shall include Geotechnical data collection for modelling purposes (ahead of the face through advance drilling and/or geophysical investigations) and for ongoing data collection during mining operations (through lithological and structural mapping of working faces). These procedures and principles shall be included in the site GCP.
  - g) The GCP shall stipulate the frequency of underground working place inspections by the competent Geotechnician/Rock Engineer and/or Strata Control Officer and responsible mining operations staff.
  - h) The Principal Geotechnical Engineer based at the corporate centre shall be responsible for regular risk assurance reviews. The sites selected to be audited shall be established in conjunction with the Business Unit at the beginning of each calendar year.
  - i) The GCP shall clearly define the process and procedure for reporting defects/non-compliances.
  - j) An Emergency Response Plan shall form part of the GCP
  - k) The GCP shall stipulate any instrumentation or monitoring systems to monitor ground movement.
  - l) The site GCP shall be reviewed by the senior Geotechnical/Rock Engineer in the Business Unit. This review period shall be risk based but shall be done at least every three years and when changes are made to the GCP. Such reviews shall focus on both safety and business risk management and potential value creation opportunities.



- m) Geotechnical/Rock Engineering design work shall be done by a competent person, as defined in Section 4.
- n) Any Geotechnical/Rock Engineering designs that do not conform to procedures and/or design principles as described in the GCP, shall necessitate a review of the GCP.

All local legislative requirements shall be used as a minimum standard for the GCP. In the absence of such a requirement, a GCP should be developed in consultation with national or international best practices.

Any ground control system shall be designed as an integral part of the mine design process.

The design and selection of equipment and materials used in ground control applications shall meet the requirements specified in the GCP, support performance specifications and shall seek to safely maximise the economic value of the Operation. The selection of such equipment shall be approved by a competent person, as defined in Section 4.

The definition of appropriate tools to be used for barring/scaling, a barring/scaling procedure, roles as well as the roles responsibilities pertaining to barring/scaling shall be included in the GCP. All these aspects shall be based upon a risk assessment of the barring/scaling activity and approved by a competent person as defined in Section 4.

Initial and on-going geotechnical analysis and assessment shall be integral parts of the mine design process and shall be carried out by a competent person, as defined in Section 4.

As part of a change management process, a documented risk assessment shall be undertaken prior to any non-routine modification of the mine operation or design, with specific consideration to the geotechnical impacts, and shall be signed off by a competent person, as defined in Section 4.

In developing, implementing or altering any ground control system, a Geotechnical risk assessment process shall be undertaken and documented, with relevant level of sign off.

A process shall be in place for assessing that ground is secure.

No person shall go beyond the area of secure ground except in specific emergency situations as defined in the Emergency Response Plan (ERP).

The ERP shall address, amongst other issues, the recovery of trapped persons or other resources (e.g. trapped under a FoG or isolated by a collapse). Drills/simulations shall be undertaken on a regular basis and a register and records shall be kept of such simulations.

Where there is potential for seismic, airblast or surface mining blast damage to occur, seismic and/or vibration monitoring (permanent or temporary) shall be carried out and, where possible, timely warning shall be provided to all personnel. In all operations ground displacement monitoring shall be conducted based on the prevailing geological, rock mass and mining conditions. The requirements and management of this ground monitoring system shall be included in the GCP, and fully integrated into mining operations, Emergency Response Plans and procedures.

A documented risk assessment shall be conducted before any remedial work is carried out to improve or regain stability, and appropriate risk reduction measures shall be adopted.

The effect of unexpected natural events, such as earthquakes or flooding, shall be considered in the mine and ground support design and procedural controls, such as Multi-tiered Ground Support Response Plans, at all operations. Site specific procedures shall be in place for the recovery of mining areas after such events. The effects of such events shall also be considered in the surface infrastructure design, such as surface drainage.

### 5.3 Plant and Equipment

Underground mining equipment design and use, as specified in AA GTS 10 AFRS Transportation Standard, shall incorporate removal or separation of the operator from unsecured ground, or the equipment shall provide a physical barrier to protect the operator in the event of an uncontrolled ground movement from hanging-wall/roof or walls/side-walls.

The mining equipment design shall take into account the forceful ejection of material into the working areas by seismicity and/or fall from a significant height (i.e. energy absorption capacity).

The design of ground support equipment shall be capable of installing support as per the specifications of the GCP without necessitating modification of the Plan.

The performance specifications of materials selected for the ground control system shall take into account the possibility of seismic events, stress build up and the potential dynamic effect of fall of ground incidents. The potentially corrosive nature of underground working environments, the potential for secondary extraction, swelling of support host material and areas prone to large movement shall be taken into consideration when selecting materials for the ground control system.

Materials used in the ground support system shall be designed and manufactured to audited standards to ensure they meet the required specifications of the GCP and performance specifications developed by the competent person, as defined in Section 4.

Equipment used in the ground control system shall be maintained and tested on a regular basis to ensure that it meets the GCP requirements and performance specifications. Support units shall be regularly tested for quality control purposes prior to installation as per the GCP. A registry and record of maintenance and testing by a competent person for equipment maintenance shall be kept.

Advances in worldwide ground control technology shall be monitored, and appropriate engineering reviews shall be conducted to determine whether new technology is valid and economically viable for implementation.

Ground support systems shall be “self-auditing” from an installed quality control perspective i.e. a built-in indicator that automatically indicates when the support unit has been correctly installed.

## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 9, AFRS 9 – Underground Stability and Optimisation Standard

- [AA RP 7](#) : Anglo American Competency Criteria for Rock Engineering/Geotechnical Staff & Service Providers
- [AA GTS 1](#) : Technical Governance Standard
- [AA GTS 2](#) : Integrated Risk Management Standard
- [AA GTS 10](#) : AFRS Underground Equipment Standard

## APPENDIX B: RECORD OF AMENDMENTS

- Issue 0 : New document based on AA AFRS 9 (February 2011, G. Ralph, I Canbulat, R Johnson, G Makusha, G Priest, D Mossop)

## APPENDIX C: SELF ASSESSMENT TOOL

[AA GTM 9, Underground Stability and Optimisation Standard Assessment Tool](#)

For more information or to give feedback on this document, please contact [M&T Risk and Assurance](#) Tel +27 11 638 2815

# AFRS 10: UNDERGROUND EQUIPMENT STANDARD

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## SECTION A: TRANSPORT

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### 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the use of transport equipment underground.

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### 2 APPLICATION

This Standard applies to all underground transport equipment, including rubber tyre mounted and rail mounted equipment designed specifically for underground use. Examples of underground transport equipment covered by this Standard include rail bound locomotives, load haul dump machines, personnel transporters, multi-purpose vehicles, graders and all transport machinery with a machine-mounted operator.

NOTE: Where vehicles/equipment would be required for both underground and surface work, the most stringent control would apply as stipulated in either the Light Vehicles or the Underground Equipment Standard.

Where underground transport machinery falls outside those mentioned above, a risk-based approach should be used to determine the level of compliance needed for each of the specific requirements of this Standard. Examples of underground transport machinery excluded from this Standard include crawler mounted development loaders, continuous miners and face production equipment without a machine-mounted operator.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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### 3 REASON FOR INCLUSION

Underground transport equipment is a core risk for underground operations. Several fatalities and high-potential incidents have occurred involving underground transport equipment. The causes of and factors contributing to these incidents have been:

- a) interactions between equipment/equipment and equipment/pedestrians (e.g. passing or working close by)
  - b) speeding
  - c) non-adherence to operating procedures
  - d) falling objects
  - e) unplanned/inadvertent movements of equipment down inclines and slopes
  - f) operator error due to fatigue or substance abuse
  - g) failure of braking systems
  - h) poor visibility and noise
  - i) poor/faulty track work and road conditions
  - j) overturning, overbalancing.
-

## 4 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties,
2. Documented and detailed risk assessment of the situation under proposed alternative control measures,
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 5 PLANT AND EQUIPMENT REQUIREMENTS

1. Underground transport equipment shall have the following minimum safety requirements unless otherwise stated as “should”:
  - should have falling object protection system (e.g. canopy or cab structure) as determined through the risk assessment process
  - automatic reversing alarm for non-track and track-bound machinery, except for bi-directional machines, which shall be fitted with an automatic system to indicate direction of travel (e.g. alternating light system)
  - flashing light/s mounted on personnel transport equipment and underground light vehicles
  - should have seat belts and/or passenger restraints
  - fail-to-safe brakes (excluding underground light vehicles with emergency brakes) and train brake systems, the design of which shall be based on risk assessments that consider runaway trains, decoupling, etc.
  - a combined automatic and manual fire suppression system, in addition to a portable fire extinguisher (with the exception of electrically-operated equipment, for which a risk-based approach shall be used)
  - restricted area and/or pinch point access controls or guarding where practicable (e.g. articulation locks for all articulated equipment, coupling devices for trains, with the locking mechanism able to be applied from a position of safety)
  - equipment should be fitted with a speed limiting device (the specific design requirements for this system should be determined using a risk assessment)

- appropriately specified collision-avoidance technology and/or procedures
  - security systems to prevent unauthorised operation.
2. Design, selection, maintenance and operation criteria shall be in place for all remote controlled equipment.
  3. Design and maintenance requirements shall be in place for all transport roadways and railways. Requirements shall include, but not be limited to, the following:
    - safe operating width, height, inclination, gradient, surface
    - regular measurement of track gauge and super-elevation, and rail head wear
    - demarcation of changed/special conditions
    - traffic flow and control
    - signage
    - shaft station and intersection stopping devices.
  4. Risk assessments shall be undertaken as part of the design (due consideration to ergonomics), selection, commissioning, operation, modification and maintenance processes for all underground transport equipment.
  5. Design, selection, maintenance and operation criteria shall be in place for all trailers (e.g. interactive braking systems). Where towing is to be considered, a risk assessment process shall be followed to ensure safe operation.
  6. Underground transport equipment should be fitted with prime power isolation mechanisms.
  7. Fail-to-safe equipment control systems (e.g. battery locomotive controllers) shall be in place.
  8. Underground transport equipment should be fitted with roadway and haulage illumination capabilities.

## 6 SYSTEM AND PROCEDURAL REQUIREMENTS

9. A formal selection and acceptance process in accordance with these Standards shall be in place for all new (to site) and modified underground transport equipment prior to commencement of work on site.
10. A procedure shall be in place to address right of way between equipment and pedestrians.
11. A procedure shall be in place to ensure that no person rides illegally on any transport equipment.
12. A procedure shall be in place to ensure safe shunting for rail bound equipment.
13. All people underground shall wear full personal protective equipment and effective reflective clothing.
14. Parking rules shall be in place including, but not limited to, the following:
  - engine should be shut down before the operator leaves the machine, except where safe operating procedures are authorised by the most senior manager of the operation, supported by documented risk assessment (e.g. changing from manual to remote operation)

- parking brakes shall be applied
  - wheels should be turned into the rib/wall or chocked, and positioned as close as possible to the rib/wall
  - all lifting and elevating attachments should be lowered or secured in the parked position when not in use and all stored energy should be released as per OEM recommendations.
15. A system shall be in place to identify the maintenance and inspection requirements for underground transport equipment. The system shall ensure that records are kept of all maintenance and inspection.
16. A process shall be in place for pre-use and operational checks, including appropriate brake tests (e.g. brake tests on a ramp) to define clearly that transport equipment is safe to operate.
17. Controls shall be in place to ensure the safety of people working in roadways and railways, including work in and around unexpected breakdowns. The controls shall include requirements for unattended broken-down equipment. The risk to employees and/or contractors shall be addressed specifically.
18. A system shall be in place to ensure compatibility between transport equipment, route, road and work area, load, traffic congestion and environmental conditions. The system shall cater for changes to any of the above or changes to a combination of any of the above.
19. A system shall be in place to ensure that transport equipment is controlled with the principle of NO operation when the driver/operator is not in full control of the machine (either directly or remotely).

## 7 PEOPLE REQUIREMENTS

20. All employees, contractors and visitors shall be inducted in appropriate road safety and site equipment/vehicle hazards.
21. A permit or certification system shall be in place to ensure drivers are competent to operate the type and class of underground transport equipment in its intended environment.
22. A system shall be in place to ensure that drivers receive adequate training to ensure that the equipment intended to be operated or driven can be operated or driven safely. As a minimum, training should include:
- behaviour-based defensive driving principles
  - equipment familiarisation, taking into account the handling dynamics, maximum number of passengers, load limits and various features
  - loading and restraining principles where the equipment intended to be operated is designed for carrying cargo loads
  - education and awareness of driving and travel risks that may be encountered within the environment where the equipment may be operated or driven and the requirement of keeping to traffic rules and speed limits
  - securing (locking) equipment to prevent unauthorised use
  - emergency crash and breakdown procedures



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- basic mechanical principles including tyre changing and how to perform an adequate pre-operation check
  - Pre-use equipment check, including brake testing.
23. A system shall be in place to ensure any person operating any equipment (e.g. vehicle-mounted cranes and winches) is suitably trained and accredited.
24. Behaviour-based observations shall include the operation and maintenance of underground transport equipment. Any need for additional specific retraining shall incorporate the results of these observations.
25. A fit-for-work policy shall be in place, incorporating the clearly defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of drivers/operators.
26. A system shall be in place to manage driver fatigue.
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## SECTION B: SCAPER WINCHES AND ATTACHMENTS

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### 1 AIM

To eliminate or minimise the risk of fatalities, injuries and incidents arising from the use of scraper winch systems underground.

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### 2 APPLICATION

This Standard applies to the use of all underground scraper winches, specifically 22kW, 37kW, 55kW and 75kW electrically-powered winches.

Where the design of the scraper winch falls outside those mentioned above, a risk-based approach shall be used to determine the level of compliance needed for each of the specific requirements of this Standard. Examples of such winches include hydraulically-powered winches.

This Standard applies to all Anglo American Group managed businesses and operations, including contractors and visitors when involved in controlled activities.

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### 3 REASON FOR INCLUSION

Underground scraper winch systems are a core risk for underground cleaning operations. Several fatalities and high-potential incidents have occurred involving these machines. The causes of and factors contributing to these incidents have been:

- a) personnel, while in the “danger triangle” of a deflecting snatchblock, being struck by scraper rope rigging after a failure of the rigging due to either improper installation, overload or equipment failure
  - b) interactions between personnel and the scraper ropes/scraper in the gulley
  - c) unplanned, inadvertent starting of the winch with personnel in the area
  - d) non-adherence to operating and signalling procedures
  - e) signalling devices inoperative
  - f) inadequate guarding of the winch drum
  - g) operator error due to fatigue and substance abuse
  - h) inadequate operator training
  - i) increased exposure to fall of ground incidents during rigging and scraping operations
  - j) scraper and rope fouling support systems affecting ground control.
-

## 4 REQUIREMENTS

Application of the Anglo Fatal Risk Standards is mandatory at all Anglo American managed businesses and operations. This mandatory nature is indicated by the use of the word “shall” within the Standards.

In some places, the word “should” is used. This means that the primary intent remains, but specific circumstances may mean that implementation of the requirements is not reasonably practicable.

Any deviation from the specifications set forth in these Standards should be formally approved following an exemption procedure.

The exemption procedure comprises the following steps:

1. Documented and detailed description of the implementation difficulties
2. Documented and detailed risk assessment of the situation under proposed alternative control measures
3. Documented formal approval from the Divisional Head of Safety and the Divisional Chief Executive Officer that the level of risk as a result of the alternative control measures is understood, tolerable for the organisation and in line with the Anglo American Group vision of Zero Harm.

## 5 PLANT AND EQUIPMENT REQUIREMENTS

27. Underground scraper winch systems shall have the following minimum safety specifications:
- effective signalling system to ensure that distinct signals can be given to the winch operator from any point along the path traversed by the scraper shovel
  - means to forewarn persons of the intention to commence operation of any scraper winch
  - selection for compatibility, in terms of mechanical design, of all the components that make up the scraper rigging, including the ropes, chains, eyebolts, bolts, shackles and snatch blocks
  - selection of all rigging components so that they are compatible with the most powerful winch at the operation, thus eliminating the risk of using the wrong components for a particular winch
  - motor overload protection set to below the minimum mechanical strength of the components in the load path
  - means for the isolation and safe lockout of the winch in the absence of an operator
  - means to enable the operator, in the event of an emergency, to isolate the power from any position in the immediate vicinity of the winch
  - guarding of the winch drums and couplings to meet the requirements of the Equipment Safeguarding Standard
  - correct installation of the winch in terms of hold-down bolts, alignment, elevation, foundations, etc.

- appropriate warning signage
  - portable fire extinguisher.
28. Risk assessments shall be undertaken as part of the design, selection, transportation, commissioning, operation, modification and maintenance processes for all underground scraper winch systems.

## 6 SYSTEM AND PROCEDURAL REQUIREMENTS

29. A formal selection and acceptance process in accordance with these Standards shall be in place for all new (to site) and modified scraper winch equipment prior to commencement of work on site.
30. A periodic review of the scraper rigging standard shall take place to ensure that the standard remains effective/applicable for changing rock conditions, mining layouts and winch sizes.
31. The operating procedure shall have specifications to address, but not be limited to, the following:
- safe transportation of scraper winches to and between operating areas
  - scraper winch installation parameters and operating procedures, including the use of the signalling system
  - pre-use and operational checks to define clearly that the scraper equipment is safe to operate
  - inspection, by a competent person, of all scraper rigging installations to ensure that they comply with this Standard prior to commencement of scraping operations
  - safety procedures for persons to cross the pathway of a scraper
  - controls to ensure the safety of people working in the vicinity of the scraper winch installation and scraping path.
32. A system shall be in place to identify the maintenance and inspection requirements for underground scraper winches. Records shall be kept of such maintenance and inspections.
33. There shall be a procedure to discharge any stored energy in hydraulic winch installations.

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## 7 PEOPLE REQUIREMENTS

34. A competency-based training system shall be in place for the installation, operation and maintenance of underground scraper winch systems.
  35. Key behaviours shall be identified and defined for the safe performance of all activities associated with scraper winch systems.
  36. A fit-for-work policy shall be in place, incorporating the clearly- defined maximum levels of drugs (including prescribed medication) and alcohol allowed in the system of operators, and a system shall be in place for fatigue management.
  37. Behaviour-based observations shall include the operation and maintenance of underground scraper winches. Any need for additional specific retraining shall incorporate the results of these observations.
  38. The formal selection and acceptance process for all new (to site) and modified scraper winch equipment shall consider ergonomic requirements.
-

## APPENDIX A: REFERENCED DOCUMENTS

AA GTS 10, AFRS 10: Underground Equipment Standard

None

## APPENDIX B: RECORD OF AMENDMENTS

Issue 0 : New document based on AA AFRS 10 (Dr. J. Wannenburg, May 2011)

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