

# The EMESRT Design Evaluation for Equipment Procurement

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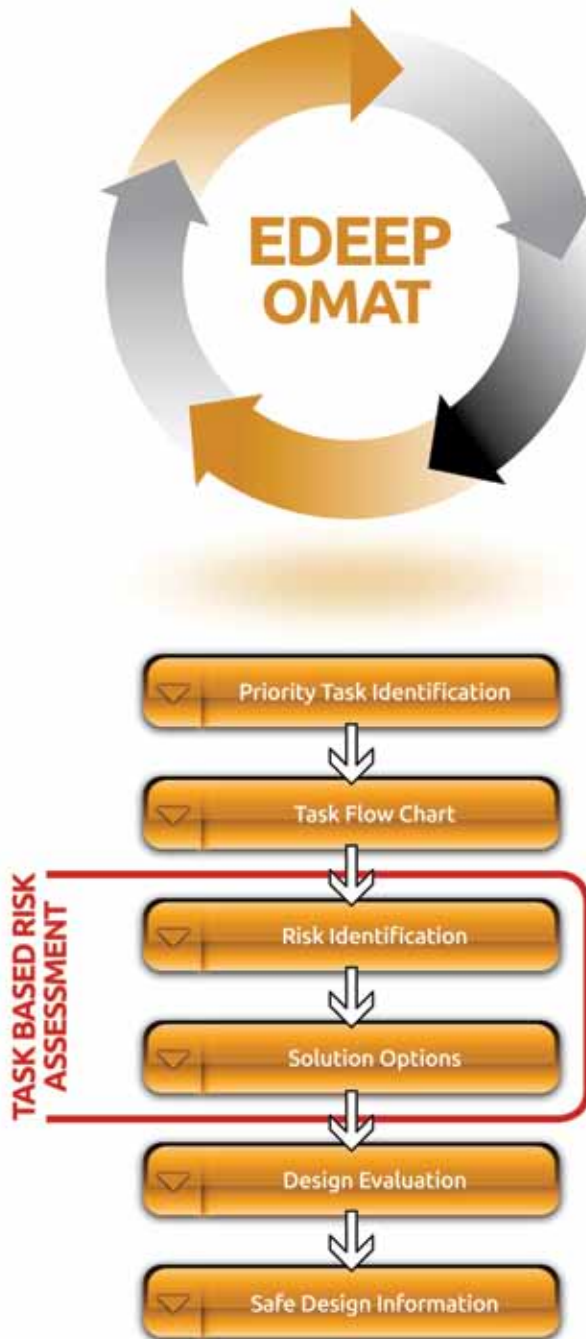
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# SECTION 1

## Introduction to the new EMESRT Design Evaluation for Equipment (EDEEP)



### SECTION 1

Introduction

### SECTION 2

EMESRT Position  
on Standards

### SECTION 3

Procurement  
Document Forms

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Design OMAT  
Training Manual

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Design Philosophies

## AN INTRODUCTION TO EDEEP

The Earth Moving Equipment Safety Round Table (EMESRT) is a global initiative involving 15 multi-national mining companies. EMESRT engages with leading mining industry Original Equipment Manufacturers (OEMs) to promote improved equipment safety through improved equipment design.

EMESRT was formed in 2006 and, since then, has met with selected OEMs on several occasions. These meetings have introduced EMESRT and its resources to OEMs and sought input on how EMESRT could help OEMs improve equipment design. EMESRT shared information regarding priority equipment related topics in the form of 'Design Philosophies' and provided a task-based risk assessment tool called OMAT (Operability and Maintainability Analysis Technique) for use in assessing the risks associated with these issues.

In 2011, EMESRT adopted the second stage of their OEM engagement strategy. A common requirement for equipment design evaluation was developed to be employed by member companies during procurement. This 'Safe Design Information' template is supplemented by a suggested process for deriving this information which involves identification of priority tasks, and subsequent task-based risk assessment considering the risks associated with potential unwanted events derived from the EMESRT Design Philosophies, and involving site based operation and maintenance personnel.

This **EMESRT Design Evaluation for Equipment Procurement (EDEEP)** provides OEMs with an opportunity to systematically document the specific design features which reduce the risks associated with relevant potential unwanted events identified within the EMESRT Design Philosophies.

The objectives of EDEEP are:

- To provide equipment purchasers with a common way of assessing how well the equipment design addresses issues identified in the EMESRT Design Philosophies.
- To provide OEMs with additional information for use during subsequent equipment design activities to facilitate 'designing beyond standards' and further reduce the risks to health and safety associated with operation and maintenance tasks.

Information about EDEEP, supported by a suite of materials including revised Design Philosophies and OMAT training materials, was provided as a draft to seven major OEMs of surface and underground mining equipment during the 2012 EMESRT OEM Tour (February-March, 2012). Feedback was requested, and the final EDEEP information and materials have been modified in the light of feedback received.

The 'bottom line' of EDEEP is a request for Safe Design Information which documents and evaluates the design features employed to reduce the risks associated with relevant potential unwanted events, including those identified within the EMERST Design Philosophies. This Safe Design Information is required to be derived from a task based risk assessment involving mining company-based operation and maintenance personnel. The information is requested in the form of the example overleaf.

## EDEEP - SAFE DESIGN INFORMATION (to be supplied to potential purchaser)

Equipment Details: Worked example - Integrated Bolter Miner

Risk Assessment reference number:

The information below summarises the outcomes of a task based risk assessment involving experienced mining com

| Task # | Task         | Potential Unwanted Event                              | EMESRT DP        | Design feature/s which control the risk of injury or illness  | Eva refer  |
|--------|--------------|---|------------------|---|--|
| 2      | Roof bolting | Hazardous Manual Tasks                                | Manual tasks     | Provision of a storage pod allowing bolts and plates and other supplies to be accessed without requiring awkward postures. Drill rigs are oriented to place drill head close to platform. Platform space adjacent to bolting rigs is ample to allow miner wearing self-rescuer and battery to get as close as possible to drill head, reducing reach distance to 0.5m. A mesh carrier is provided which allows a mesh to be loaded via LHD and brought forward to the bolting rigs without manual handling. An adjustable height platform is provided to minimise awkward postures associated with reaching roof mesh. Control layout and design allows operation without exposure to awkward postures or forceful exertions. | Attac draw on th in rel weari The a (Attac of the indep while a con the erisk o An as contr (Attac |
| 2      | Roof bolting | Struck by materials/<br>Caught between moving objects | Harmful energies | Two handed control operation is required for fast feed operations. Hydraulic hosing in the operator workstation is behind covers or otherwise protected.  | Engin from fast-f requi audit  |

EMESRT has also provided a suggested process by which this information may be derived. The process starts with an identification of priority operation and maintenance tasks based on the frequency with which the tasks are undertaken, and the maximum reasonable consequences associated with 20 potential unwanted events derived from the EMESRT Design Philosophies.

**PRIORITY TASK IDENTIFICATION (For OSM records only)**

**Task Frequency:**  
 1. Monthly  
 2. Quarterly  
 3. Annually  
 4. Weekly  
 5. Rolling  
 6. Pre-incident only

**Reaction Response Consequence:**  
 1. Minor: No treatment or first aid only  
 2. Moderate: Medical treatment, no lost time  
 3. Serious: Lost time injury  
 4. Severe: Single fatality or serious irreversible injury, illness  
 5. Catastrophic: Multiple fatalities or serious irreversible injury

Equipment details: Marked Example - Integrated Bolt Raiser Miner

| Task No. | Task Name  | Frequency | Reaction | Response          | Consequence | Priority |
|----------|--|-----------|----------|-------------------|-------------|----------|
| 1        | Retrieve bolt, plate and chemical from storage pod at rear of continuous miner | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 2        | Walk along platform to bolting workstation                                     | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 3        | Place drill steel in chuck   | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 4        | Place roof mesh into position  | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 5        | Operate controls to raise timber jack, then drill into roof and lower chuck    | Monthly   | Major    | Medical Treatment | Major       | High     |
| 6        | Remove drill steel   | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 7        | Place bolt in chuck  | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 8        | Operate controls to raise bolt to roof   | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 9        | Place resin in drill hole and raise bolt using controls                        | Monthly   | Minor    | First Aid         | Minor       | Low      |
| 10       | Operate controls to bolt, then lower chuck                                     | Monthly   | Minor    | First Aid         | Minor       | Low      |

**COMPLEX TASK-BASED RISK ASSESSMENT (For OSM records only)**

Equipment reference number: Marked Example - Integrated Bolt Raiser Miner

| Task No. | Task Name  | Equipment                    | Task Location                           | Risk Assessment | Control Measures  | Residual Risk |
|----------|--|------------------------------|---|-----------------|---|---------------|
| 1        | Retrieve bolt, plate and chemical from storage pod at rear of continuous miner | Integrated Bolt Raiser Miner | Storage pod at rear of continuous miner | Low             | None  | Low           |
| 2        | Walk along platform to bolting workstation                                     | Integrated Bolt Raiser Miner | Platform                                | Low             | None  | Low           |
| 3        | Place drill steel in chuck   | Integrated Bolt Raiser Miner | Chuck                                   | Low             | None  | Low           |
| 4        | Place roof mesh into position  | Integrated Bolt Raiser Miner | Platform                                | Low             | None  | Low           |
| 5        | Operate controls to raise timber jack, then drill into roof and lower chuck    | Integrated Bolt Raiser Miner | Platform                                | High            | 1. Safe work procedures and training<br>2. Personal protective equipment (PPE)<br>3. Safety barriers and signage<br>4. Operator training on emergency stop<br>5. Regular maintenance and inspection | Low           |
| 6        | Remove drill steel   | Integrated Bolt Raiser Miner | Chuck                                   | Low             | None  | Low           |
| 7        | Place bolt in chuck  | Integrated Bolt Raiser Miner | Chuck                                   | Low             | None  | Low           |
| 8        | Operate controls to raise bolt to roof   | Integrated Bolt Raiser Miner | Platform                                | Low             | None  | Low           |
| 9        | Place resin in drill hole and raise bolt using controls                        | Integrated Bolt Raiser Miner | Platform                                | Low             | None  | Low           |
| 10       | Operate controls to bolt, then lower chuck                                     | Integrated Bolt Raiser Miner | Platform                                | Low             | None  | Low           |

- Task Flow Chart**
1. Retrieve bolt, plate and chemical from storage pod at rear of continuous miner
  2. Walk along platform to bolting workstation
  3. Place drill steel in chuck
  4. Place roof mesh into position
  5. Operate controls to raise timber jack, then drill into roof and lower chuck
  6. Remove drill steel
  7. Place bolt in chuck
  8. Operate controls to raise bolt to roof
  9. Place resin in drill hole and raise bolt using controls
  10. Operate controls to bolt, then lower chuck

**EDEEP - SAFE DESIGN INFORMATION (To be supplied to potential purchaser)**

Equipment Details: Marked Example - Integrated Bolt Raiser Miner  
 Risk Assessment reference number: [Reference Number]

The information below summarizes the subsequent, task based risk assessment conducted by the mining company's operational and maintenance staff

| Task No. | Task Name  | Equipment                    | Task Location                           | Control Measures | Residual Risk | EDEEP - SAFE DESIGN INFORMATION  |
|----------|--|------------------------------|---|------------------|---------------|--|
| 1        | Retrieve bolt, plate and chemical from storage pod at rear of continuous miner | Integrated Bolt Raiser Miner | Storage pod at rear of continuous miner | Low              | Low           | Position of a storage pod at rear of continuous miner... (Details of task and associated risks and controls)                                     |
| 2        | Walk along platform to bolting workstation                                     | Integrated Bolt Raiser Miner | Platform                                | Low              | Low           | Design of platform should ensure that the walking surface is free from trip hazards...   |
| 3        | Place drill steel in chuck   | Integrated Bolt Raiser Miner | Chuck                                   | Low              | Low           | Training and education of operators to ensure that they understand the correct sequence of operations...   |
| 4        | Place roof mesh into position  | Integrated Bolt Raiser Miner | Platform                                | Low              | Low           | Design of platform should ensure that the mesh is held in position by a secure locking mechanism...  |
| 5        | Operate controls to raise timber jack, then drill into roof and lower chuck    | Integrated Bolt Raiser Miner | Platform                                | High             | Low           | Design of platform should ensure that the operator has a clear view of the roof and the timber jack... (Detailed description of safety features) |
| 6        | Remove drill steel   | Integrated Bolt Raiser Miner | Chuck                                   | Low              | Low           | Design of platform should ensure that the operator has a clear view of the chuck and the drill steel...  |
| 7        | Place bolt in chuck  | Integrated Bolt Raiser Miner | Chuck                                   | Low              | Low           | Design of platform should ensure that the operator has a clear view of the chuck and the bolt...   |
| 8        | Operate controls to raise bolt to roof   | Integrated Bolt Raiser Miner | Platform                                | Low              | Low           | Design of platform should ensure that the operator has a clear view of the roof and the bolt...  |
| 9        | Place resin in drill hole and raise bolt using controls                        | Integrated Bolt Raiser Miner | Platform                                | Low              | Low           | Design of platform should ensure that the operator has a clear view of the drill hole and the resin...   |
| 10       | Operate controls to bolt, then lower chuck                                     | Integrated Bolt Raiser Miner | Platform                                | Low              | Low           | Design of platform should ensure that the operator has a clear view of the bolt and the chuck...   |

Having defined the priority tasks, the next step is to conduct a risk assessment of each task. To gain an accurate understanding of the risks associated with each task, it is essential that the risk assessments involve mining company-based operation and maintenance personnel. The OMAT process is provided as a possible means of performing and documenting these assessments. The outcomes of these risk assessments can be used to populate the Safe Design Information template for provision to prospective purchasers, and also as input into subsequent equipment re-design.

## RELATIONSHIP TO ISO 12100

Several OEMs provided feedback in response to the EDEEP draft which noted that the manufacturers' existing risk assessment methods were based on ISO 12100 and ISO/TR14121-2.

ISO12100-2010 'Safety of machinery — General principles for design — Risk assessment and risk reduction' provides a strategy for risk assessment which stipulates that the designer shall: (i) determine the intended use and foreseeable misuse of the equipment; (ii) systematically identify the hazards and associated hazardous situations; (iii) estimate the risk for each circumstance and hazard; (iv) evaluate the risk; and (v) eliminate the hazard or reduce the risk. Task-based risk assessment is required in that the 'hazardous situations' referred to in step (ii) of this strategy are defined as 'circumstances in which a person is exposed to at least one hazard'. The standard requires the systematic identification of these circumstances, and notes that to achieve this it is necessary to 'identify the operations to be performed by the machinery and the tasks to be performed by persons who interact with it, taking into account the different parts, mechanisms or functions of the machine, the materials to be process, if any, and the environment in which the machine can be used. ... All reasonably foreseeable hazards, hazardous situations or hazardous events associated with the various tasks shall then be identified' (section 5.4, p.15, emphasis added).

Further, ISO12100 section 5.2 stipulates that the information required for risk assessment (analysis & evaluation) should include 'the experience of users of similar machines and, wherever practicable, an exchange of information with the potential users'. That is, ISO12100 requires task-based risk assessments, and recommends user involvement. ISO/TR14121-2 similarly notes that the team conducting a risk assessment should include those with 'actual experience' of how the machine is operated and maintained.

The OMAT process outlined here is thus entirely consistent with the requirements and recommendations of ISO 12100. OEMs may use equivalent processes to undertake the risk assessment, and if these are similarly consistent with the the requirements and recommendations of ISO 12100, then the information to populate the 'Safe Design Feature' template requested by EMESRT should be readily available. However, whatever process is employed, it must:

- (i) include identification and risk assessment of the tasks associated with the equipment in which people are exposed to hazards;
- (ii) include consideration of the relevant potential unwanted events identified by EMESRT;
- (iii) involve mining company-based operators and maintenance personnel in the risk assessment; and
- (iv) provide documentation of the tasks and hazards assessed (although not necessarily the risk scores), and the design features which have been employed to eliminate the hazards or reduce the risks as far as reasonably practicable.

If an alternate process to that described here is utilised, a description of the process is requested to be provided with the Safe Design Information.

## **IN SUMMARY:**

EDEEP provides a vehicle for mining companies considering the purchase of equipment to obtain high quality information about equipment safety features in a standardised form. Completing the EDEEP process or equivalent will provide OEMs with high quality information to assist designing 'beyond standards'.

This information kit provides background materials including the EMESRT Design Philosophies, and a manual describing the Operability and Maintainability Technique for task-based risk assessment, and a spreadsheet for use in documenting the priority tasks, task based risk assessments and the resulting Safe Design Information, as well as a more detailed explanation of the process outlined in this Introduction.

If there are any questions about these materials, please contact EMESRT at [info@EMESRT.org](mailto:info@EMESRT.org).