

Rope Handling Informative Check List

Introduction

Hoisting systems at mines utilise steel wire ropes. Maintenance of these wire ropes requires specialist knowledge and skills. There are many technical considerations and risks present which are not found with other common maintenance tasks. These risks may or may not be immediately obvious. The most frequently conducted rope handling tasks include: installing, removing, cropping, lubricating, NDT inspections and changing attachments of Winder, Guide and Rubbing Ropes.

Many rope handling tasks require the temporary construction of a system which integrates multiple machines such as: a Reeler, Winch and Winder. The integration of the control of these machines is a key area in which risks can be reduced. Traditionally, the operation of temporary systems has relied upon procedural controls and human reactions. The importance of using engineering controls and isolating people from potential hazardous zones during rope handling tasks cannot be over-stated!

Information relating to rope handling:

- The Ropeman's Handbook: National Coal Board
- Handling, Installing and Maintenance of Steel Wire Ropes: CASAR

Task Preparation

Rope handling tasks require careful planning and execution. There are many details common to every rope handling task. However, every task will have unique characteristics which require engineering design and risk management processes to be utilised.

- Rope handling activity planning should outline responsibilities, accountabilities, supervision, and validation requirements.
- Rope handling activity plans should document the purpose, hazard identification, methods, techniques, and controls for safe operation.
- Rope manufacturer's information and rope handling equipment instructions must be considered when preparing the rope handling activity.

Rope Handling Informative Check List

Engineering and Task Analysis

Rope handling activities should be developed with input from engineers or otherwise competent persons who have the necessary skills relating to the task.

Technical engineering determinations for the rope handling task should be made including:

- Analysis of rope handling mechanisms including calculations, testing or examination that may be required.

Information must be provided about:

- the installation, commissioning, use, handling, decommissioning and dismantling of the plant, and
- the hazards and risks associated with the use of the plant that the task has identified, and
- testing or inspections to be carried out on the plant, and
- the systems of work and competency of operators that are necessary for the safe use of the plant, and
- the emergency procedures that are required to be implemented if there is a malfunction of the plant.
- Results of consultation with stake holders detailing hazards identified in the design of the task that have been by the manufacturer or users of the plant.

Specific engineering requirements for rope handling:

- Engineered plan that accounts for the site configuration and accommodates necessary geometry, rope tensions and mechanisms for rope handling.
- Winding torques, forces, resulting from winder drive limits, momentum forces, brake application, gravity or tension forces.
- Rope tensions resulting from above conditions.
- Reaction forces from rope tensions on components.
- Stability and structural capacity of component structures and anchors.
- Rope tension control, rope torsion energy, end of rope management, system stability and control.
- Control systems.
- Specification of limits of use or any conditions required to operate safely.
- Hazard identification and risk assessment including assessment of foreseeable hazards, failure modes, foreseeable misuse, human and organisational factors. Design and operational risks to be assessed by a suitably qualified team that represents stake holders involved with the rope handling activity.
- Inspection and test plans for rope handling installations.
- Engineered procedures and safe work methods including management of energies that are developed based on assessment of risks.

Rope Handling Informative Check List



Rope Handling Informative Check List

Review and Consolidation – Check list

The following check list is intended as a tool to assist in the planning and execution of rope handling tasks for all types of winders. Not all items apply to every winder. While this list is extensive it does not include detail relevant to every situation. There are always site-specific factors which must be considered! This check list does not provide instruction on rope handling techniques and the mitigation of risks; it provides prompts for considering the presence of risks which may not be obvious. If there are items in this check list which you do not understand, this should be a prompt to seek further information and guidance. Please contact a Rope Handling Specialist for assistance with the planning and execution of Rope Handling tasks.

Implementation

Once the rope handling task has been engineered, the duty of persons installing, commissioning, and operating the plant must be managed having regards to:

- Information provided by the engineers and competent persons relating to safety.
- Implementation of engineered systems.
- Implementation of administrative controls including procedures and methods determined for the task.
- Using persons who are competent for the task and supervised for the activity.
- Using change management controls for any emerging conditions that arise during the activity.

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.00	PROCEDURE					
1.01	Does the procedure specify tension settings required at each stage of the job?					
1.02	Does the procedure include adjusting maximum tensions for the weakest link?					
1.03	Does the procedure include a reliance on human reactions to prevent over-tension?					
1.04	Does the procedure include how to release tension in a system?					
1.05	Does the procedure include how to setup Fine Adjustment Linkages to equalise rope tension?					
1.06	Have the correct tension settings of machines been verified during the planning process?					
1.07	Have the correct tension settings of machines been verified during task execution?					
1.08	Are "Emergency Procedures" included in the procedure?					
1.09	Has the procedure been used or tested before?	errors in procedure				
1.10	Have Change Management procedures been followed for modified equipment or procedures?	errors in procedure				
1.11	Does the procedure list all permits required for task completion?	hot work, nil isolation, work at heights, confined space				

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.12	Does the procedure include tasks requiring working on live or rotating equipment permit?	using copper hammer for bottom layer, controlling rope reeving due to large Fleet Angle				
1.13	Does the procedure include using a copper hammer to ensure first layer wrap tightness while running?	risk of entanglement				
1.14	Does the procedure include NDT of rope?	before installation, after installation				
1.15	Does the procedure include recalibration of conveyance position once rope / ropes installed?					
1.16	Does the procedure include verification that barricading is correctly installed?					
1.17	Does the procedure detail how to manage the rope catenary?	positive control, rope damage				
1.18	Does the procedure detail how to manage personnel change during task execution?	operator change "on the go", whole job stops, unplanned personnel change				
1.19	Does the procedure include emptying conveyances?	payload, personnel, material, reliance on load cell, verification				
1.20	Is releasing rope torque included in the procedure?	method to release rope torque safely when disconnecting attachments				
1.21	Is there enough detail in procedure?	tension settings, torque settings, pressure settings				

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.22	Is the procedure too large and impractical to use in the field?					
1.23	What assumptions have been made in the procedure?	reliance on personnel memory				
1.24	Has operator error been considered?	unexpected movement, unexpected stop, excessive tension				
1.25	Can steps be incorporated to verify the effectiveness of procedural controls?	verification of settings, verification of task completion				
1.26	Is there coherence between different documentation relevant to the task?	Procedure, SWMS, Task Analysis, Take 2, Risk Assessment, operation manuals				
1.27	Is there a reliance on maintaining slack in the procedure?	minimum tension setting too high				
1.28	Will a dangerous event occur if intended slack disappears?	excessive tension				
1.29	Has the development of the procedure included an engineering analysis?	loads on structures, tensions, site specific				
1.30	Has the rope handling procedure been reviewed by an experienced specialist?					
1.31	Does the procedure include the installation, commissioning, use and dismantling of machines according to manufacturer's specifications?					
1.32	Is the appropriate procedure for rope capping available?	specific to capping, OEM				

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.33	Is there an accurate equipment layout plan drawing?	accurate setup of machines				
1.34	Is the rope cutting equipment appropriate?	pinched cutting discs, hand held, cut off saw, spark containment				
1.35	Has adequate time been allowed for planning?	unidentified risks				
1.36	Has adequate time been allowed for execution?	rushing				
1.37	Has there been compartmentalisation of the planning process?	awareness of the "big picture", integration of different aspects of task				
1.38	Have the different disciplines been communicating effectively during the planning process?	Electrical, Mechanical, Hydraulic, Rope Specialist				
1.39	Have previous job reports been reviewed for lessons learned?					
1.40	Have equipment maintenance records been reviewed?					
1.41	Has a review of any engineering reports and risk assessments been done before task commencing?					
1.42	Have all the recommendations of any engineering reports and risk assessments been followed before task commencing?					
1.43	Have all documented hazards and risks been controlled before task commencing?	Risk Assessments, Task Analysis, Take 2, engineering reports				

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.44	Has the extent of the "Line of Fire" been determined?	What happens if an item fails and releases tension / falls / shifts?				
1.45	Is the standard site definition of "Line of Fire" appropriate for the Rope Handling task?					
1.46	Is industry best practice followed for connection of tigger winch ropes to winder ropes?					
1.47	Are conveyances adequately supported during rope handling?					
1.48	Does communication between personnel require line of site and hand signals?					
1.49	Are "Control Zones" used for access to areas close to the "Line of Fire"?					
1.50	Do the conditions for entry into a "Control Zone" adequately deal with the risks to personnel?					
1.51	Have "Exclusion Zones" been adequately defined?					
1.52	Have "Control Zones" and "Exclusion Zones" been adequately barricaded?	hard barricading, soft barricading, signs, information tags				
1.53	Is the control of persons entering and exiting the "Control Zones" and "Exclusion Zones" effective?					
1.54	Are site barricading standards adequate for rope handling tasks?					
1.55	Have Site Introduction Procedures been followed for new equipment?					

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
1.56	Are Site Introduction Procedures appropriate for the specific new equipment?	too generic, asking the right questions				
1.57	Are all Safety Data Sheets (SDS) for consumables available?					
1.58	Have the winder drums been inspected after rope removal?					
1.59	Is use of a Winder clutch necessary?					
1.60	Are there effective methods in use for checking personnel understanding of the maintenance procedure?					
1.61	Are site isolation procedures appropriate for the rope handling task?	too time consuming, remote isolation, effective				
1.62	Are the risks with working near suspended loads dealt with effectively?	ropes hanging in shafts				
1.63	Are the risks of lowering of ropes vertically dealt with effectively?	twist, entanglement, kinks, damaged services				
1.64	Does the method of assisting with tracking of rope reeving require personnel to be in or near the "Line of Fire"?					
1.65	Are the risks associated with changing multiple ropes simultaneously being dealt with effectively?	twist, entanglement, kinks, damaged services, machine coordination, excessive				
1.66	Have Pre-start inspections been documented?					

Rope Handling Informative Check List

Item	Description	Prompts	Yes	No	N/A	Notes
1.67	Have ITP's for equipment setup and installation been completed?	hold down bolt torques, testing of interlocks, testing of Dead-man functions				
1.68	Have ITP's for rope installation and capping been completed?	torque, curing time, pressure				
1.69	Has equipment and loose items been removed from the head frame and work area after task completion?					
1.70	Has a post job review been completed?	lessons learnt, maintenance requirements identified, future improvements				

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
2.00	RISK MANAGEMENT					
2.01	Are all personnel aware that Rope Handling is a High Risk activity?					
2.02	Are there site specific risks?					
2.03	Has a Risk Assessment for rope removal been conducted?					
2.04	Has a Risk Assessment for rope installation been conducted?					
2.05	Has a Risk Assessment for rope cropping been conducted?	front end, back end, pulling rope through attachments				
2.06	Has a Risk Assessment for the specific task and machines in use been conducted?					
2.07	Have all ITP's been completed?	attachment refurbishment, equipment installation, rope installation				
2.08	Is there a SWMS (Safe Work Method Statement) for the task?	relevant, specific				
2.09	Are any "Failure Mode and Effects Analysis's" (FMEA) required?	equipment specific, handling process				
2.10	Have the task risks been reduced to "As Low As Reasonably Practical" (ALARP)?	Is the company being "tight"? Are people being lazy?				
2.11	Can more engineering controls be used?	automatic functions on machines				

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
2.12	Can reliance on procedural controls be reduced?	reduce reliance on human skill and reactions				
2.13	Have the specific risks identified by equipment manufacturer's been mitigated?					
2.14	Have all "Line of Fire" zones been identified?					
2.15	Are there appropriate controls in place to ensure that personnel are not in "Line of Fire" zones?					

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
3.00	REGULATORY					
3.01	Has the minimum tension required for rope installation been determined?	TRG 2020				
3.02	Have the minimum seizing lengths and correct techniques been determined?					
3.03	Have the minimum rope strengths been determined?					
3.04	Have the maximum layers of rope on a drum been determined?					
3.05	Have the minimum qualifications of personnel been determined?	planning, engineering, execution				
3.06	Have the requirements of applicable Australian Standards been complied with?					
3.07	Have the requirements of applicable State Regulations been complied with?					
3.08	Have the requirements of applicable Codes of Practice been complied with?					

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
4.00	PEOPLE					
4.01	Do personnel understand how individual machines operate?	pre-start, tension setting, post job shut down				
4.02	Do personnel understand how connected machines operate as a system?	different tensions on different sides of a machine, start-up order, interlocks				
4.03	Do personnel understand the communication protocols?	hand signals, radio calls, sirens, warning lights				
4.04	Do personnel understand the differences between "Control Zones" and "Exclusion Zones"	conditions for entry, purpose, dangers				
4.05	Do personnel have appropriate experience?	specialists, done the job well before, task specific experience, enough experienced personnel on the task				
4.06	Do personnel have the appropriate training?	machine specific, rope handling, specialised tasks, planning, qualifications				
4.07	Do personnel have the correct tickets?	EWP, Franna, fork lift, winch, winder, work at heights, confined space				
4.08	Are all personnel trained, authorised and approved for work on site?	temporary worker approval, site inductions				

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List

Item	Description	Prompts	Yes	No	N/A	Notes
4.09	Have all personnel involved in the task engaged in a review of the procedure before task commencement?					
4.10	Have all personnel involved in the task engaged a in review of the SWMS before task commencement?					
4.11	Have the locations of people during task execution been determined?	"Line of Fire", moving				
4.12	Are there enough people to complete the task safely?	at least 1 operator per machine in use, spotters,				
4.13	Is personnel fatigue effectively managed?	Is site procedure good enough?				
4.01	Is there a plan for task continuity at break time?	operator change "on the go", whole job stops				
4.02	Is there a plan for task continuity at shift change?	operator change "on the go", whole job stops				

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
5.00	Equipment					
5.01	Has the maximum allowable tension for each piece of equipment under tension been considered?	What is the weakest link?				
5.02	Is there a minimum tension required for a piece of equipment?	Capstans, Chimes, Friction Winches				
5.03	Is tension control able to be set to the correct limits?	low, high, fine enough control				
5.04	Are rope tensions of different machines displayed in the same units?					
5.05	Have actual tension inducing capabilities of machines been calculated instead of reliance on nominal ratings?	de-rating of electric motor capacity, efficiency allowances				
5.06	Have actual tension capabilities been calculated for entire process, considering different number of rope layers on drums?					
5.07	Is tension measured directly by all machines?					
5.08	Are independent load cells needed to measure and confirm tension?					
5.09	Is all measuring equipment calibrated?	torque, tension, pressure, amps				
5.10	Have all machines been tested to prove they can achieve the desired tension?					
5.11	Are machine tensions set mechanically?					

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
5.12	Are machine tensions set electrically?					
5.13	Are machine tensions set in a PLC program?					
5.14	Do the machines in use hold tension on start up?					
5.15	Do the machines in use start up at minimum tension?					
5.16	Do the machines in use start up at maximum tension?					
5.17	Are the machines in use suitable for the type and construction of rope?	Rope diameter – Drum diameter Rope clamps				
5.18	Have the effects of higher brake capacity than tension capability been considered?					
5.19	What happens to tensions when only one piece of equipment stops?	slack rope, excessive tension				
5.20	What happens to tensions when all equipment stops?					
5.21	Have "Run Interlocks" between machines been installed and tested?					
5.22	Have "Estop Interlocks" between machines been installed and tested?					
5.23	Does each machine have a Dead-man control function?					
5.24	Have all Dead-man functions and Interlocks been tested?					

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
5.25	Does equipment documentation detail any differences between nominal ratings and actual capability?					
5.26	Have the brake capacities been calculated and considered?	higher or lower than tension capability?				
5.27	Has the direction and magnitude of loads on equipment and structures under load been calculated for all scenarios?					
5.28	Is all equipment rated for the possible loads?	bearings, shafts, reels, hold down bolts, sheaves, shackles, structures				
5.29	Is modification of existing equipment necessary?	change management				
5.30	Is it possible to control all machines from one location?					
5.31	Is the control of machines and equipment possible outside the "Line of Fire"?					
5.32	Is CCTV available for spotting to ensure no workers are in the "Line of Fire"?					
5.33	If used, are there enough radios to support effective work group communication?	every machine operator, spotters, supervisor				
5.34	Have radios or other forms of communication been tested for effectiveness in the actual work environment?	noise, static, electrical interference				
5.35	Is machine labelling clear and easy to understand?					
5.36	Are machine ergonomics for operators acceptable?					

Rope Handling Informative Check List

Item	Description	Prompts	Yes	No	N/A	Notes
5.37	Can synthetic fibre ropes be used instead of steel ropes for tugger winches?	lighter, stronger, less stretch compared to similar size steel rope				
5.38	Have the torque settings for rope clamp bolts been defined?					
5.39	Are the correct size rope clamps and glands available?					
5.40	Is anything uncommon about a piece of equipment that requires extra attention or training?	method of operation, no direct display of tension				
5.41	Does the Winder have a specific rope change mode?					
5.42	Does the Winder require a specific rope change mode?	safe temporary disabling of safety measures				
5.43	Are all necessary consumables available?					
5.44	Is all necessary tooling available?					
5.45	Are replacement ropes the correct size, construction and suitable for the required duty?	rope certificates, design review				
5.46	Are replacement rope attachments inspected and tested?					
5.47	Are rope certificates available?					
5.48	Is equipment available to hold rope and socket while resin or white metal sets?					

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
5.49	Is the correct Capel Banding Press available?	manufacturer's specification				
5.50	Are tools for working at heights fitted with lanyards?					
5.51	Is suitable fire-fighting equipment available?					
5.52	Are suitable cranes available for lifting conveyances, attachments, ropes, winches etc.?					
5.53	Has all equipment followed site introduction procedures?					
5.54	Is the correct length of rope on tugger winches?					
5.55	Are suitable anti-spin bars for controlling rotational torque in ropes available?					
5.56	Are the ropes appropriately lubricated?					
5.57	Is the Winder drum appropriately lubricated?					
5.58	Is lubrication equipment secured correctly?					
5.59	Can Fleet Angles be maintained without external control?					
5.60	Are deflection sheaves required?	preventing rope from hitting structures				
5.61	Have the loads on sheave anchor points been considered?	higher than actual rope tension				

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx

Rope Handling Informative Check List



Item	Description	Prompts	Yes	No	N/A	Notes
5.62	Does the equipment layout minimise rope angles and deflections?	tight bends around sheaves, high loads on sheaves				

Item	Description	Prompts	Yes	No	N/A	Notes
6.00	ENVIRONMENT					
6.01	Will noise in the work area have an adverse effect on the rope handling task?	communication, operator health				
6.02	Will the weather have an adverse effect on the rope handling task?	rain, heat, sun, cold, wind				
6.03	Has spill prevention been considered?					
6.04	Are spill containment preparations appropriate?	different chemicals				
6.05	Is the lighting suitable?	too much, too little, reliance on cap lamps				
6.06	Are the hazards of the work area effectively dealt with?	clean, tidy, muddy, uneven, loose footing				
6.07	Is there dust in the work area which can affect equipment and personnel?					
6.08	Does the traffic management plan adequately deal with the risks to personnel?					
6.09	Are there simultaneous operations in the same work area?					

Revision: 0

Date: 01/02/2023

Ref:

230201 Rope Handling Informative.docx