

# EXPLOSIVE USE OPERATIONAL PLAN

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BC Ministry of Transportation Avalanche and Weather  
Programs  
2021

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## Definitions

<i>anchor</i>	The part of a fall protection system that connects to an anchorage.
<i>Avalanche Guard</i>	A remotely fired avalanche control device that is comprised of towers mounted with magazines that contain mortar barrels with propellant and explosive charges.
<i>ALARP</i>	Engineering standard; As Low As Reasonably Practicable.
<i>blaster</i>	A person who holds a valid blaster's certificate issued by WorkSafeBC.
<i>blaster of record</i>	The blaster who is designated to oversee a blasting operation.
<i>blasting area</i>	An area extending at least 50 m (165 feet) in every direction from a place where explosive materials are being prepared or fixed, or where an unexploded charge is known or believed to exist.
<i>blasting operation</i>	Work that involves preparing, placing, and firing a charge, handling a misfire, and/or destroying or disposing of explosive materials.
<i>case charge</i>	The detonation of explosives, often multiple bags of ammonium nitrate/fuel oil (ANFO), which have been placed (as opposed to thrown or dropped) at the bottom of the targeted avalanche path.
<i>charge</i>	Explosive materials, which may or may not contain a primer, placed for the purpose of detonation.
<i>cornice control</i>	An avalanche control technique where personnel on the ground use mountain rope access techniques to safely place charges and/or detonate several charges at once with detonating cord.
<i>danger area</i>	An area in which there may be danger to persons or property from flying material or other hazardous conditions resulting from a blast. The danger area

	includes the blasting area, all areas affected by the blast concussion and materials, and all terrain where avalanches could result from the use of the applied explosives.
<b><i>dangerous incident</i></b>	An accident or near miss resulting from the use of explosives, including an unexpected result or problem with explosive products.
<b><i>detonator or detonator products</i></b>	Explosives used to detonate commercial explosives, commonly called “blasting caps” or “electric caps,” or other similar devices.
<b><i>explosive</i></b>	A substance that is made, manufactured, or used to produce an explosion or detonation, including but not limited to blasting explosives, pyrotechnic devices and accessories containing explosives.
<b><i>fall restraint system</i></b>	A system to prevent a worker from falling or moving to an unguarded steep edge.
<b><i>hand charging</i></b>	A technique where personnel on the ground throw or place explosives into the avalanche path start zone. Often performed while wearing skis.
<b><i>helicopter deployment</i></b>	A drop placement of explosives from a helicopter to perform avalanche control.
<b><i>misfire (mishole)</i></b>	A dangerous condition in which a charge or part of a charge fails to completely detonate or function on initiation.
<b><i>mislight</i></b>	A type of misfire where there is a failure or perceived failure of a pull-wire lighter to ignite the safety fuse assembly.
<b><i>lanyard</i></b>	A flexible line of webbing, rope or wire rope that is used to secure a safety belt or full body harness to a lifeline or anchor.
<b><i>primer</i></b>	An explosive to which a detonator or other initiating device has been attached.

*safety fuse assembly*

A manufactured blasting accessory consisting of a precut length of safety fuse, an igniter cord connector, and a detonator.

*Wyssen Tower*

A remotely fired avalanche control device that drops an explosive charge hanging from a cord at a pre-set height above the snowpack. Two igniters are pulled, and the explosion is set off after a delay

## **I. GENERAL PROCEDURES**

### **A. INTRODUCTION**

The Avalanche and Weather Program's unit in the British Columbia Ministry of Transportation and Infrastructure administers an integrated avalanche risk management program along provincial highways in British Columbia. A key aspect of this program is the use of explosives to release unstable snow under controlled circumstances to mitigate a current or potential avalanche hazard. The ministry's avalanche control programs also use explosives to analyze snowpack stability and evaluate the overall avalanche hazard.

The purpose of this Explosives Use Operational Plan is to define the personnel, competencies, procedures, specific safety measures, training, equipment, and primary locations used by ministry staff in carrying out this important work.

**B. GENERAL AVALANCHE CONTROL RATIONALE**

The ministry artificially triggers avalanches to reduce the threat of naturally triggered avalanches along provincial highways.

Predicting where and when avalanches could occur requires a thorough understanding of the interaction between weather, terrain, and the mountain snowpack. The ministry's analysis draws on this expertise, supported by many observations and tests.

The decision to conduct explosive control is based on a complex analysis of current and future weather and snowpack conditions, and the effect these conditions may have on the avalanche hazard.

Appendix A identifies the ministry's avalanche explosives use program areas.

**C. REGULATING AUTHORITIES**

Explosive treatment for avalanche risk management is regulated by the Prevention Division of WorkSafeBC [OHS Part 21].

Regulations for the storage of explosives used by the ministry's avalanche control programs are governed by the Explosives Regulatory Division of Natural Resources Canada.

The transportation of explosives for the ministry's avalanche control programs operates in accordance with the Transportation of Dangerous Goods Act, governed by Transport Canada.

The ministry's Manager of Avalanche and Weather Programs is responsible for the site-specific procedures, review, approval, and quality assurances of the Explosives Use Operational Plan.

#### **D. PERSONNEL AND CERTIFICATION**

All blasting operations and teams must have at least one blaster with a WorkSafeBC Code 1 blasting certificate and the appropriate endorsements for the control method being employed. When more than one certified blaster is present in a team, a blaster of record must be designated to oversee all aspects of the blasting operation [OHS 21.5 (1)(2)].

All blasters have up to date certifications, accreditations, education and/or experiential equivalent, and training standards compliant with provincial and federal regulations, and ministry policies to work with explosives for avalanche control.

Blasting operations must have a minimum of two personnel: the blaster and an assistant. Exceptions may apply in helicopter control operations as specified in the respective procedural descriptions. If the assistant does not hold a valid blasting certificate (with required endorsements), the blaster is required to visually supervise the assistant and is responsible for their work during explosive priming, initiation, and deployment [OHS 21.5(3)].

Blasters must be familiar with the manufacturer's handling recommendations [OHS 21.36], as well as current legislation and regulations concerning all relevant aspects of explosive acquisition, transportation, storage, use and disposal. All blasters are required to review these procedures annually during a training session prior to the avalanche season.

Blasters are also responsible for immediately reporting any theft or attempted theft of explosives to the Chief Inspector of Explosives under Natural Resources Canada's Explosives Regulatory Division.

Any dangerous incident involving explosives, whether there is personal injury, must be reported to WorkSafeBC [OHS 21.3]. Such incidents are also to be immediately reported to the Manager of Avalanche and Weather Programs.

## **E. HANDLING OF EXPLOSIVES**

Specific explosive preparation procedures are contained in each respective avalanche control operation procedure. Explosive materials must be stored, transported, handled, and used in a manner recommended by the manufacturer of the material [OHS 21.36].

The blaster of record will determine the most appropriate primer assembly location closest to the blasting site, while ensuring that explosives and detonators are brought together at the last most practicable moment [OHS 21.85 (2)].

The blaster of record will select their crew for risk reduction treatments, capturing all opportunities within our integrated risk management plan.

A person operating a vehicle transporting explosives (a) must operate the vehicle in a safe manner, consistent with prevailing road and weather conditions, and (b) must not drive faster than 90 km/hr. [OHS 21.29].

If the AWP have an explosives spill along the highway, they will initiate the MOTI AWP Emergency Response Assistance Plan 2-0804.

## **F. CLOSURES/SWEEPS**

The danger area includes the blasting area, all areas affected by the blast concussion and materials, and all terrain where avalanches could result from the use of the applied explosives.

The danger area must be cleared before the commencement of each avalanche control operation and confirmed clear by radio communication. Maintenance contractors or ministry personnel must execute road closures and perform sweeps prior to every ministry avalanche control operation. Where backcountry users are possible, a visual sweep of the danger area will be performed.

Blasting signals for avalanche control are not necessary, as per WorkSafeBC regulation 21.69, provided the above measures are taken to ensure safety within the blast area.

Signs warning of expected avalanche control should be used whenever feasible at off-highway access points to the danger area, to inform backcountry users of the ministry's local avalanche control operations.

Traffic control persons with warning signs and physical barriers will be used at each highway end of the closure area. The sweep vehicle(s) is responsible for travelling the highway between the identified closure points to ensure that no traffic remains within the danger area and that it is safe to proceed with avalanche control operations. The sweep vehicle(s) will notify the blaster of record by radio once it has left the danger area.

Once avalanche control is complete, the blaster of record will notify the maintenance contractor personnel on site. Provided no further avalanche activity is expected, the maintenance contractor is responsible for clearing the highway of avalanche deposits and ensuring it is safe to reopen to the public.

If there has been a misfire at all during the season and has not been located nor disposed of, a qualified blaster needs to be at the site when the avalanche deposits are being cleared out in case the misfire is found in the deposit.

## **G. RECORDS KEEPING**

Standard avalanche observation records are to be kept for each explosive placed and its results. These records include the time, date, location, type and size of explosive, detonation status, avalanche characteristics and any resulting damage, as well as closure and sweep start and end times. Refer to the Canadian Avalanche Association's *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches* for further details.

Ministry avalanche programs will also record details of all explosive use in a blasting log. Blasters will also keep records of all blasting operations in their personal blasting log [OHS 21.4].

A copy of the ministry's Avalanche and Weather Programs' Explosive Use Operational Plan will be kept by the blaster of record on site and will be available for inspection by members of WorkSafeBC staff upon request.

## H. MISFIRE DISPOSAL PROCEDURES

All misfires and suspected misfires are to be recorded in keeping with the standard records. Their location is to be marked as soon as possible and georeferenced to identify the area to be searched later. Suspected misfires are explosions that may have detonated properly, but which may not have been observed due to; deep snowpack's, caught in an avalanche, strong winds or poor visibility.

Misfires are to be disposed of as soon as safely possible. Care shall be taken to ensure that a misfire is not disturbed. It should be detonated with a hand charge if possible; using a new primer that is placed in contact with the unexploded material [OHS Guideline 21.75]. Non-sparking shovels shall be used when digging for misfires within the snowpack.

A waiting period of at least one hour, as recommended by the manufacturer [OHS 21.36], must be observed before the control team approaches the misfire location. If a misfired charge contains a safety fuse and is re-blasted, workers must not return to the blast site until 30 minutes after detonation [OHS 21.36].

A qualified blaster needs to be at the highway deposit site in case the misfire is uncovered by the Maintenance Contractor's machine.

In the event snow or avalanche conditions prevent access to the misfire, it must be left until conditions have reached an acceptable risk level.

Due to the inaccessibility and inherent danger of travelling in avalanche start zones, misfires may be left until spring melt conditions enable safer access. At least two patrols throughout the spring and summer should be conducted to discover and dispose of misfires. These recovery missions are usually performed as soon as the snow melts and before significant vegetation growth.

Locations requiring access to very steep or hazardous terrain must adhere to the OHS guidelines applicable to the techniques being employed.

Access points where recreationists could enter areas affected by ministry avalanche control operations, must have physical barriers with signs warning users of the dangers of misfires. If blocking access to the area is not feasible, prominent warning signs with current information must be clearly visible at all access points.

## **I. STANDARD DISPOSAL OF EXPLOSIVE PRODUCTS**

If it becomes necessary to dispose of any explosive products, the disposal of these explosive products must be conducted in accordance with the manufacturers' recommendations.

The ministry no longer uses artillery rounds for avalanche control; however, dud projectiles or failure-to-fire rounds could be found. In this event, rounds must be disposed of by appropriately trained personnel from the RCMP or Department of National Defense.

### **ACCIDENTAL IGNITION OF SAFETY FUSE WHEN PREPARING THE WYSSEN TOWER**

- 1** Prior to assembly of the primers, the assembly team will identify:
  - a.** An accidental ignition area
  - b.** Human evacuation area
- 2** The person recognizing an accidental ignition will call: " ignition, evacuate, evacuate!"
- 3** The person handling the charge will take the charge container to the predesignated accidental disposal area and retreat quickly out of the danger area. Whenever possible frontal and overhead protection will be used.
- 4** Everyone else will move to the predesignated evacuation area at least 50 meters from the deposited charge
- 5** Confirm detonation of charge
- 6** Observe the minimum waiting period of 30 minutes or greater as recommended by the manufacture before approaching the charge in case detonation is not confirmed
- 7** Cease assembly operation and review the incident

**J. EXPLOSIVE USE REVIEW AND REVISION PROTOCOLS**

The Manager of Avalanche and Weather Programs will review these procedures annually [OHS 21.85 (4)].

Avalanche program personnel will regularly review the procedures to ensure they reflect current industry best practices. Amendments of this document will be subject to review by the Manager, prior to submission to WorkSafe BC for approval.

## II. OPERATIONAL PROCEDURES

### A. HELICOPTER DEPLOYMENT PROCEDURES

#### 1. Equipment

- Helicopter with radio set to highway closure frequency
- Intercom headsets or flight helmets (preferred)
- Fall restraint system, including approved harness or belt, anchor(s), and lanyard [Transport Canada TDG CAR 527]
- Timing device(s)
- Blasting log (notebook, tablet, etc.)
- Explosives (ANFO, cast boosters, safety fuse assemblies, etc.)
- Pull-wire lighters
- Blasting tools and accessories (burlap, tape, zip ties, etc.)

#### 2. Personnel

The blasting team consists of a helicopter pilot and a blaster of record. Additional blasters or assistants may be used, with a maximum of four personnel on board during active control.

- i) Pilot is responsible for the following:
  - a) Operation and safety of the aircraft and occupants
- ii) Blaster of Record is responsible for the following:
  - a) Safety in the use of the explosives
  - b) Directing the pilot to avalanche sites
  - c) Ensuring that the area closure and sweep is complete
  - d) Preparing, igniting, and dropping explosives on to the slopes
  - e) Recording the time of burning fuses
  - f) Recording the placement of charges
  - g) Recording the observations (detonation and results)
  - h) Re-opening the road (or sections of the road) to workers for maintenance and deposit removal and/or to the travelling public.
  - i) Ensuring all members of the team understand the blasting plan, their role, and responsibilities.

Any member of the blasting team has the responsibility and authority to call a halt to the avalanche control mission if they believe that worker safety is, or is likely to be, compromised.

\*Note: When additional blasters or assistants are being used, the blaster of record is responsible to ensure that additional team members understand which parts of the blasting operation they are to perform. Blasters without a helicopter

endorsement may prepare and deploy charges; however, they must be under direct visual supervision of a qualified blaster [OHS regulation 21.5(3)].

### **3. Preparation of Explosives**

Primed charges are to be made up prior to entering the aircraft, at the last practicable moment and as close to the helicopter landing zone as safety permits [OHS 21.85(2)]. Pull-wire lighters must be transported separate from charges.

A minimum of a one-meter safety fuse must be used [OHS 21.56(2)]. A specific WSBC Variance allows 30 cm safety fuse assembly for Wyssen Tower and Avalanche Guard.

Ideally, all explosives carried by the helicopter will be used during a particular control mission. If primed explosives have not been used and the mission is complete, the fuse and explosive of the primed charge may only be separated if the primer is a cast booster. The products' manufacturers must approve the procedure [OHS 21.36].

Primers transported in the helicopter must use a container made of antistatic material (e.g. wood) capable of being easily jettisoned.

Provisions:

- A minimum amount of fuse should be exposed outside of the bag (approximately 10-25cm)
- The helicopter staging area should be near target locations. Primed bags of ANFO should not be flown considerable distances [OHS21.85(2)]
- If requested by the pilot, the sleeve of the ANFO bag can be securely taped shut to contain prills. Burlap covers or other means should also be considered to aid in containing prills and preventing ANFO bags from sliding on hard snow surfaces

#### 4. Preflight Safety Check

All persons working in the blasting mission around the helicopter will discuss the procedures and processes for the mission. Topics will include:

- Working safely around the helicopter
- Safe refueling, explosive assembly and helicopter loading areas
- Experience levels of the blaster of record, pilot and assistants-both individual experience and experience working together as a team. Consider using dry run flights with limited weight on board to build experience as a team before conducting a live explosive mission
- Weather conditions and any weather-related terrain access limitations
- Fuel, personnel, and explosive loads – consider the terrain, weather and elevations expected for the mission
- Harness anchor points
- Safety instructions for ground support personnel
- Mission specific terrain considerations and a discussion of safe standoff distances (blade strikes) – see Safety Precautions 7 (a) (page 20)
- Seating arrangements and the limitations of pilot visibility when the blaster is seated side opposite from the pilot – see Safety Precautions 7 (c) (page 21)
- Radio call signs and channels/frequencies for support and closure personnel
- Targeting, and how the blaster and/or assistant will guide the pilot to the targets
- Blasting run commands
- Methods for emergency jettison of explosives
- Method the team will use for timing the 90 second period after the first fuse is lit
- Safe standoff distance from the blast and the avalanche in motion (dust clouds, airborne debris)
- Mis-light procedures and predetermined placement locations
- Ensuring that all members of the mission team understand they can abort the mission if they feel any unsafe condition is about to arise.

## 5. Procedures – Pre-Flight

- a) The pilot will arrange the helicopter in an appropriate manner to ensure that explosives can be safely dropped (e.g. remove the rear door and/or ski basket or racks as required).
- b) The pilot and blaster will ensure that the intercom and radio on closure frequency are functioning correctly.
- c) The blaster will attach a lanyard to two related anchor points in the helicopter that is approved by the pilot and check the lanyard for correct length.
- d) The blaster will put on an approved harness or belt with a non-instantaneous release system and attach it to the helicopter via the anchor lanyard. The assistant(s) will be suitably restrained by standard safety belts.
- e) A complete dry run will be instituted on the ground, including the use of the harness, intercom, stopwatch, field notebook and bombing commands, to ensure all systems are operational and understood.
- f) Closure and sweep are to be initiated at a time that is appropriate for the mission.
- g) If required, primers will be loaded aboard the helicopter in a suitable container so that they can be easily jettisoned, if necessary.
- f) The explosives will be loaded into the helicopter. Primed bags of ANFO may be used.
- g) The pilot or additional team member will verbally or visually check the blaster's tie in.

## 6. Procedures – In-Flight

- a) Ensure that the road closure and sweep of the highway is complete and any necessary visual sweep from the helicopter has been performed [OHS 21.66(2)(3)].
- b) The blaster will ready the primer and lighter as the helicopter approaches the target area.
- c) The blaster will trim the fuse no more than 10 centimeters and attach the lighter. Dialogue should be as follows:  
Blaster: "Lighter on"  
Pilot: "Lighter on"
- e) The blaster will direct the pilot into the final position for shot placement.

- f) The blaster will take approximately ***five seconds*** to confirm the burning fuse  
Burning indications will include:
- visible grey smoke
  - acrid smell of smoke
  - discoloured fuse
  - fuse droop
- g) The blaster will not apply a non activated pull wire lighter on the safety fuse assembly earlier than necessary

If the blaster confirms that the fuse is NOT burning, he will announce to other team members "MIS-LIGHT." Confirmation from team member(s) and pilot is necessary.

Once the pull-wire has been activated, the pull-wire igniter manufacturer's instructions dictate that the charge must be deployed and no further attempt to re-cut or re-light the fuse will be attempted. Locations for mis-light placement should be discussed prior to the control mission for ease of access after the elapsed wait time for disposal.

**Mis-Lights** must be placed in predesignated **safe location immediately**.

**Important Notice:**

Manufacture's approximate safety fuse burn rates.

- 40 seconds per foot At Sea Level
- 46 seconds per foot at 6000' asl
- 48 seconds per foot at 8000' asl

Helicopter explosives placement Safety Fuse Assemblies are 3.3 feet (1 Meter) in length, hence at 6000' asl it will take 132 seconds, (2 minutes 12 seconds) from ignition to detonation. +/- 10%.

- h) After ensuring that the fuse is lit, the dialogue should be as follows:
- Blaster: "Fuse lit"  
Pilot: "Fuse lit"
- i) **DROP** the charge down and away from the helicopter.  
Blaster: "Shot is away"  
Pilot: "Shot is away"
- k) Record the time and location
- j) If the charge slides away from the target, the blaster should communicate this to the team and, where practical, the helicopter should move to a location to observe the final resting place of the charge and/or primer.
- l) When ***multiple primed charges*** are being deployed, placement of all charges will ***stop 90 seconds*** after lighting of the ***first fuse***. The helicopter will then move to a safe location to observe the detonations and results.
- m) Record the results (and any misfires).
- n) Notify closure control personnel when blasting operations have been completed.

## **7. Safety Precautions**

- a) All blasting team members must be mindful of the need to always maintain sufficient standoff distance between the helicopter and the surrounding terrain.
- b) The blaster should be seated on the same side of the machine as the pilot
- c) Explosive charges should be deployed with the blaster and pilot facing the uphill slope. If contrary winds prevent this orientation, it will be left to the discretion of the blaster and pilot to determine one of the following options:
  - i. deploy shots on the downhill side.
  - ii. deploy shots on the uphill side, with the blaster seated on the side opposite the pilot. If this option is selected, use greater standoff distances from the terrain to allow for the compromised pilot visibility of this seating configuration.
- d) When using the “large” charge technique (multiple charges at the same placement), ANFO bags should be unprimed, except for the final shot. The requirement for extended hover and accurate shot placements needs to be considered when assessing the feasibility of using a “large” charge.
- e) When deploying hand charges from the helicopter, the blaster’s hand must be on top of the shot with the thumb facing down toward the ground. The charge should be pushed down and away from the aircraft when released.
- f) The lighters are to be placed on the fuses at the last possible moment.
- g) In the event of an emergency, the pilot must request or approve the jettison of explosives.
- h) The blasting team will decide if weather conditions are safe; however, the pilot will make all flying decisions.
- i) Extra personnel, other than those in training situations, shall not be on board the helicopter during any phase of the explosives control operation.
- j) A minimum distance of one meter should be maintained between a landing helicopter and explosives to reduce the possibility of static discharge.
- k) At no time shall a primer be assembled or dismantled in a helicopter.

## **8. Misfires and Disposal**

For mis-lights and misfires, refer to Section I: General Procedures (H), "Misfire Disposal Procedures" (page 13) and Section I: General Procedures (I), "Standard Disposal of Explosive Products" (page 14).

## **9. Helicopter Loading Calculations and Considerations**

The pilot is responsible for ensuring that the total weight of explosives, personnel and equipment inside the helicopter does not exceed the aircraft’s maximum gross weight limit. In addition, the pilot will determine the weight of 75 per cent of the Hover-Out of Ground Effect (HOGE) based on the highest altitude planned on the flight in order to calculate the maximum weight of explosives that may be loaded in the helicopter.

Department of Transport Regulations require helicopter operators to obtain approval to permit dispensing of explosives from rotorcraft and Transportation of Dangerous Goods certificate of training.

## **B. CASE CHARGE PROCEDURES**

### **1. Equipment**

- Truck and portable radios set to the highway closure frequency
- Timing device(s)
- Blasting log (notebook, tablet, etc.)
- Explosives (ANFO, cast boosters, safety fuse assemblies, etc.)
- Pull-wire lighters
- Blasting tools and accessories
- Hearing protection

### **2. Personnel**

The blasting team consists of a minimum of a blaster of record and an assistant. Only personnel directly involved in the control work will be in the danger area.

- i) Blaster of Record - is responsible for the following:
  - a) Safety of the entire blasting operation.
  - b) Ensuring that all members of the team understand the blasting plan, their roles, and responsibilities.
  - c) Ensuring that the area closure and sweep is complete.
  - d) Placement and location of charges.
  - e) Record keeping (times, locations, results, etc.)
  - f) Re-opening of the road (or sections of the road) to workers for maintenance and deposit removal and/or to the travelling public.

Any member of the blasting team has the responsibility and authority to call a halt to the avalanche control mission if they believe that worker safety is, or is likely to be, compromised.

### **3. Preparation of Explosives**

- a) Prepare primers at the most appropriate safe location closest to the blast site [OHS 21.85(2)].
- b) Assemble explosives according to manufacturers' recommendations [OHS 21.36].
- c) Primers should be double fused when practical.
- d) No sparking materials should be present when transporting primers.
- e) Safety fuse igniters must be kept dry and should be transported separately from primers.

#### **4. Procedures**

- a) Ensure that the highway sweep/closure has been performed and that the danger area around the blasting site is clear.
- b) Park motor vehicle so that it can be quickly and directly driven away from the blasting site. Do not turn the engine off.
- c) Charges should be placed on a pillow of snow above the gravel shoulder. Care must be taken to place explosive charges in a fashion that will not result in damage to the road. Suspended in the air with a tripod is also acceptable.
- d) Light the fuses and confirm burn. See 6(f) in Section II.A. "Procedures for Helicopter Deployment of Explosives" (page 16).
- e) After ensuring that the fuses are lit, immediately drive out of the danger area.
- f) Record the results.
- g) Notify closure control personnel when blasting operations have been completed.

#### **5. Safety Precautions**

- a) If natural avalanche activity is possible, the blasting plan should consider risk treatment options such as blasting into the avalanche area; placing the truck between the blaster and the slope for charge placement; and using a designated watchman with a signaling device.
- b) Every effort must be made not to work directly beneath the area of the avalanche path being controlled by the case charge.
- c) Hearing protection is to be used during detonation.
- d) Longer safety fuses may provide additional safety margins when case charging. Some examples of situations where their use should be considered include: the possibility of natural avalanche activity; multiple charges being deployed simultaneously; and the possibility of vehicles becoming stuck. It is the responsibility of the blaster of record to ensure that there is ample time for members of the team to clear the danger area, including situations where unforeseen events may occur.

#### **6. Misfires and Disposal**

Refer to Section I: General Procedures (H), "Misfire Disposal Procedures" and Section I: General Procedures (I), "Standard Disposal of Explosive Products"

## **C. HAND CHARGE PROCEDURES**

### **1. Equipment**

- Portable radios
- Timing device(s)
- Blasting log (notebook, tablet, etc.)
- Explosives (cartridge primer, cast boosters, safety fuse assemblies, etc.)
- Pull-wire lighters
- Blasting tools and accessories (tape, rope, etc.)
- Hearing protection

### **2. Personnel**

The blasting team should have a minimum of two members: one blaster of record and an assistant.

Blaster of Record - is responsible for the following:

- a) Safety of the entire blasting operation.
- b) Ensuring all members of the team understand the blasting plan and their roles and responsibilities.
- d) Ensuring that the area closure is complete and danger area is clear.
- e) Placement and location of charges.
- f) Record keeping (times, locations, results, etc.)

Any member of the blasting team has the responsibility and authority to call a halt to the avalanche control mission if they believe that worker safety is, or is likely to be, compromised.

### **3. Preparation of Explosives**

See Section II.B.3 - "Case Charge Procedures: Preparation of Explosives" (page 22).

### **4. Procedures**

- a) Initiate danger area closure and sweep.
- b) Trim the fuse(s) no more than 10 centimeters immediately prior to attachment of the pull wire lighter. Announce: "Lighter on" so that the other team members hear and ensure that they acknowledge it.
- c) Light the fuse and confirm the burn. See 6(f) in Section II.A. "Procedures for Helicopter Deployment of Explosives" (page 16).
- d) After confirmation, notify the other team members by announcing "Fuse Lit" and deploy charge.
- e) All team members move to a pre-determined safe location.
- f) Record the results.
- g) Notify closure control personnel when blasting is complete.

**5. Safety Precautions**

- a) The blaster of record and assistant(s) must always be in contact.
- b) Hearing protection is to be used during detonation.
- c) Consider using longer length safety fuse assemblies if there is uncertainty about the length of time required to move to a safe location.
- d) Rope or cord may be used to position charges and prevent them from sliding.

**6. Misfires and Disposal**

Refer to Section I: General Procedures (H), "Misfire Disposal Procedures" (page 13) and Section I: General Procedures (I), "Standard Disposal of Explosive Products" (page 14).

## D. AVALANCHE GUARD PROCEDURES

### 1. Equipment for Loading

- Explosives
- Safety-fuse assemblies
- Avalanche Guard pull-wire lighters
- Propellant cup assemblies
- Replacement lanyards and twin connector hooks
- Fire control computer and communication equipment
- Portable radios
- Blasting tools to cut fuses and crimp pull-wire lighters
- Keys for Avalanche Guard controls and magazines

#### Additional Equipment for Unloading

- Container for safety fuse/detonator
- Container for safety fuse/pull-wire lighters
- Container for explosives
- Container for propellant cups

### 2. Personnel

The blasting team for loading and unloading consists of a blaster of record and assistant(s).

i) Blaster of Record - is responsible for the following:

- a) Safety of the entire operation
- b) Lock-out of Avalanche Guard system
- c) Supervision of the assembly (or disassembly) of the charges
- d) Supervision of the destruction of disassembled pull-wires, fuses, and detonators
- e) Ending of the lockout, returning the system to service
- f) Post-loading function and communication tests

ii) Assistant - is responsible for the following:

- a) Assisting in the assembly (or disassembly) of the charges
- b) Assisting in the destruction of disassembled pull-wires, fuses, and detonators
- c) Observing for anomalies during assembly and loading

Any member of the blasting team has the responsibility and authority to call a halt to the procedures if they believe that worker safety is, or is likely to be, compromised.

### **3. Avalanche Guard Loading Procedures**

#### **3.1 Preparing the Avalanche Guard for Loading**

On arrival at the launching device, proceed as follows:

- a) Place the lower service platform, handrails, and ladder into position.
- b) The blaster of record unlocks the control cabinet.
- c) Turn the switch in the control cabinet to the SERVICE position using the secure control box key. The complete firing control system is now LOCKED OUT while the switch is in the SERVICE mode. Remove the key from the service switch.
- d) Place the upper service platform, handrail, and ladder into working position.
- e) Unlock and open the terminal access panel.
- f) Remove the launching squib leg wires from the contact panel. Shunt each pair of leg wires as they are removed by twisting the bared ends together.
- g) Use the secure control box key to turn the key switch on the bottom of the launching box to the DOOR OPEN position. The door of the launching box will swing open. Remove the key from the switch. The blaster of record must now retain this key in his or her possession to ensure LOCK-OUT for the duration of the procedure.
- h) Check the launching device housing, including the door for icing and soiling. Clean as required.
- i) Remove all used launching cups and leg wires. Check to ensure the wing nut on the bottom outside of the barrel is backed out so as not to disrupt loading of the charge.
- j) Check the barrels for icing and soiling. Clean as required.
- k) Inspect the lanyards and twin connector hooks and replace if worn or damaged. Tuck the lanyards into operational position.
- l) Ensure the barrel retention wing nut is tight on all barrels.

### **3.2 Procedure for Loading - Charging the Barrels**

- a) Remove a propellant cup from the packaging and test for continuity using an approved galvanometer. Shunt the leg wires by twisting the bared ends together.
- b) Run the leg wires up the side of the charge in the 9 o'clock position.
- c) Insert the charge into the barrel, propellant end first. Leg wires remain in the 9 o'clock position and the fuse tie down strap in the 12 o'clock position. Lower the propellant cup and charge into the barrel until the top end is flush with or below the upper rim of the barrel.
- d) Hand-tighten the wing nut at the bottom of the barrel to secure the propellant cup.
- e) Pass the leg wires down the conduit and through the numbered hole in the top of the connection panel that corresponds to the number of the barrel being loaded.
- f) Repeat this procedure for each barrel that is being loaded.

### **3.3 Procedure for Loading - Fusing the Explosive**

- a) Remove a one-meter fuse assembly from the packaging and insert the detonator into the cap well of the first charge. Ensure the detonator is at the bottom of the 10 cm deep cap well. Secure the fuse by hand-tightening the screw-down fuse holder at the top of the cap well. Repeat this step with a second one-meter fuse in the second cap well of the same charge.
- b) Cut both fuses to the correct length using an approved fuse cutter.
- c) Crimp a pull-wire lighter onto each fuse using an approved crimping tool. DO NOT remove the protective cap from the pull-wire lighter.
- d) Pass both fuses through the fuse tie down strap attached to the explosive charge and loosely tighten the tie down strap. Do not tighten the fuse tie down strap all the way currently.
- e) Repeat these steps for each barrel that is being loaded.

### **3.4 Procedure for Loading - Attach Lanyards**

- a) Remove the protective caps from both pull-wire lighters of one charge.
- b) Attach the twin hooks on the end of the lanyard to the eyehooks on the pull-wire lighters.
- c) Tighten the fuse tie down strap onto the pull-wire lighters until the fuses are held securely.
- d) Replace the lanyard cover.

- e) Cover the end of the barrel with a plastic bag and use a rubber band to secure.
- f) Repeat this procedure for each barrel being loaded.
- g) The assistant inspects each charge to ensure all lanyards are connected and all barrels are covered.

### **3.5 Returning Avalanche Guard to Operating Mode**

- a) The blaster of record turns the secure control box key to the DOOR CLOSED position and removes the key after the door is fully closed.
- b) Connect the leg wires to the terminals starting with the leg wire for barrel number one. Repeat this for each barrel that is loaded, connecting the wires to the terminal of the same number as the barrel number.
- c) Close and lock the terminal access panel.
- d) Fold away the upper service platform, ladder, and handrails.
- e) Insert the secure control box key into the key switch in the control cabinet and switch from the SERVICE (locked out) position to the AUTOMATIC position. The firing system is NO LONGER LOCKED OUT. The key cannot be removed in this position.
- f) Lock the control cabinet and remove the key.
- g) Fold away the lower service platform, ladder, and handrails.
- h) Use the fire control computer to confirm system readiness.

## **4. Avalanche Guard Unloading Procedures**

### **4.1 Preparing the Avalanche Guard for Unloading**

On arrival at the launching device, proceed as follows:

- a) Place the lower service platform, handrails, and ladder into position.
- b) The blaster of record unlocks the control cabinet.
- c) Turn the switch in the control cabinet to the SERVICE position using the secure control box key. The complete firing control system is NOW LOCKED OUT while the switch is in the SERVICE mode. Remove the key from the SERVICE switch.
- d) Place the upper service platform, handrail, and ladder into working position.
- e) Unlock and open the terminal access door.
- f) Remove the launching squib leg wires from the contact panel. Shunt each pair of leg wires as they are removed.
- g) Use the secure control box key to turn the key switch on the bottom of the launching box to the DOOR OPEN position. The door of the launching box will swing open. Remove the key from the switch. The blaster of record must now retain this key in his or her possession to ensure LOCK-OUT for the duration of the procedure.

### **4.2 Procedure for Unloading - Detonator Removal**

- a) Using an approved fuse cutting device, cut a section approximately 15 cm in length out of each fuse between the fuse tie down strap and the detonator.
- b) Loosen the screw-down fuse holder at the top of the cap well, gently pull the fuse and detonator out of the mortar and place them in the detonator container. Repeat this for all fuses in each charge that is being unloaded.
- c) Cut the fuse tie down strap. Detach the twin lanyard hooks from the eyehooks on the pull-wire lighters and put them in the used pull-wires container.
- d) Repeat this procedure for each barrel being unloaded.
- e) Remove the detonator container and the pull-wire lighter container to a safe location off the service platforms.

### **4.3 Procedure for Unloading - Remove Explosive and Propellant**

- a) Loosen the propellant cup clamping screws, then extract the explosive charge, propellant cup, and leg wires.
- b) Place the explosive in the explosive's container.
- c) Place the propellant cup in the propellant cup container.

- d) Repeat this procedure for each barrel being unloaded.
- e) Remove the explosives container and the propellant cup container to a safe location off the service platforms.

#### **4.4 Securing Avalanche Guard after Unloading**

- a) Close and lock the terminal access panel.
- b) The blaster of record turns the secure control box key to the DOOR CLOSED position and removes the key after the door is fully closed.
- c) Fold away the upper service platform, ladder, and handrails.
- d) Insert the secure control box key into the key switch in the control cabinet and switch from the SERVICE (locked out) position to the AUTOMATIC or OFF position. The firing system is NO LONGER LOCKED OUT. The key cannot be removed in this position.
- e) Lock the control cabinet and remove the key.
- f) Fold away the lower service platform, ladder, and handrails.

#### **5. Procedures for Remote Firing of the Avalanche Guard System**

- a) Initiate area closure.
- b) Proceed to the safe firing location.
- c) Ensure that the closure is effective, and the area is clear.
- d) Use the firing control computer to fire the selected Avalanche Guard on the selected target.
- e) Detonation will be confirmed by the firing computer through the geophone.
- f) Check for misfire and fall out procedures. Refer to Section I: General Procedures (H), "Misfire Disposal Procedures" (page 13).
- g) Record the results.
- h) Repeat steps (d) through (g) for the next target(s).
- i) Notify closure control personnel that blasting is complete.

#### **6. Safety Precautions**

- a) The blaster of record and assistant(s) must always be in contact.
- b) No flammable or sparking materials may be carried in the same containers as the explosives, detonator assemblies, pull-wire lighters, or propellant cups.
- c) Only cast explosive primers made for the Avalanche Guard may be used.

7. **Misfires and Disposal**

Refer to Section I: General Procedures (H), "Misfire Disposal Procedures" (page 13) and Section I: General Procedures (I), "Standard Disposal of Explosive Products" (page 14).

## **E. CORNICE CONTROL – BURIED CHARGE PROCEDURES**

### **1. Equipment**

- Portable radios
- Timing device
- Blasting log (notebook, tablet, etc.)
- Explosives (ANFO, cast boosters, safety fuse assemblies, detonating cord, etc.)
- Pull-wire lighters
- Blasting tools and accessories
- Hearing protection
- Appropriate mountaineering equipment

### **2. Personnel**

The blasting team consists of a blaster of record and an assistant(s).

- i) Blaster of Record - is responsible for the following:
  - a) Safety of the entire operation
  - b) Determining appropriate primer assembly location closest to blasting site
  - c) Supervision of the construction of the explosive network
  - d) Ensuring that the area closure is complete
  - e) Designating the cornice charge placement locations
  - f) Ensuring that all team members are aware of the blasting plan, routes and safe alternative routes and rope techniques being employed

Any member of the blasting team has the responsibility and authority to call a halt to the avalanche control mission if they believe that worker safety is, or is likely to be, compromised.

### **3. Preparation of Explosives**

See Section II.B.3 - “Case Charge Procedures: Preparation of Explosives” (page 22).

### **4. Procedures**

- a) Identify the work area and proper belay locations and techniques.
- b) Lay out a section of detonating cord along the length of the area to be blasted. Include enough extra cord to have the end of the detonating cord well off the cornice area. Cut the detonating cord from the roll. Secure both ends with ski poles.
- c) Dig or punch holes in the snow at the required spacing and depth.
- d) Bury an explosive charge with detonating cord assembly.
- e) Extend detonating cord branch line back to a safe area.
- f) Once all charges are placed, properly connect the detonating cord branch lines from the charge to the main trunk line.
- g) Move everyone out of the blasting area and remove ski poles from the ends of the detonating cord.

- h) Ensure the highway sweep/closure has been performed and that the danger area around the blast area is clear.
- i) Properly attach two safety-fuse assemblies to one end of the detonating cord and notify the team.
- j) Trim the fuses immediately prior to the attachment of the pull-wire lighters. Say "Lighter on" and get confirmation from other team members.
- k) Light the fuses and confirm burn. See 6(f) in Section II.A. "Procedures for Helicopter Deployment of Explosives" (page 16).
- l) After ensuring that the fuse is lit, notify team members by saying "Fuse lit."
- m) Move to a pre-determined safe location to await detonation.
- n) Check for misfire and fall out procedures. Refer to Section I: General Procedures (H), "Misfire Disposal Procedures" (page 13).
- o) Notify closure control personnel that blasting is complete.
- p) Tape detonating cord section ends before storage to prevent magazine contamination.

## **6. Safety Precautions**

- a) The team members must always be in contact.
- b) Safety fuse assemblies must be carried separately from detonating cord and other explosive products and should be attached to the trunk line immediately prior to performing the blast.
- c) Hearing protection is to be used during detonation.
- d) If the travel time to safety precludes any of the above, then longer sections of either detonating cord or safety-fuse shall be used to activate the explosives.
- e) Personnel must comply with WSBC Part 34.4 Training and Certification (1) Before allowing a person to perform rope access, the employer must ensure and document that the person (a) has received training in the safe use of rope access systems, as appropriate to the work being done, the safe work practices, skills and practical experience hours described in the following Groups: (i) RATA, (ii) SPRAT, (iii) ACMG.
- f) Blasters must ensure that det cord is compatible with the primer being used.

## **7. Misfires and Disposal**

Refer to Section I: General Procedures (H), "Misfire Disposal Procedures," and Section I: General Procedures (I), "Standard Disposal of Explosive Products."

# WYSSEN AVALANCHE TOWER

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## *EXPLOSIVE USE PROCEDURES*

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## 1.0 Introduction

Wyssen Avalanche Towers (WAT) will be used for avalanche control on the Trans-Canada Highway (TCH) at Three Valley Gap (3VG). A WAT is a remote avalanche control system (RACS) that an avalanche technician uses to deploy explosives into an avalanche starting zone. The system is operated from a safe location on the highway by means of a digital interface (e.g. tablet or laptop computer) connected to an encrypted communication system (e.g. radio, GSM). Explosives are dropped by remote mechanism from a removable deployment box installed at the top of a tower and are suspended several meters above the snow surface. The deployment box holds up to twelve explosive charges (up to 4.5 kg) that are detonated individually.

These procedures describe blasting equipment used with the WAT, personnel training, the assembly and loading of explosives in the tower deployment box, flight operations for transport of the tower deployment box by helicopter, deployment of the explosives using the remote system, and misfires. Procedures are in accordance with WorkSafe BC (WSBC) Occupational Health and Safety Regulations (OHS) Part 21 – Blasting Operations and Part 29 - Aerial Operations, Natural Resources Canada Explosive Regulations, Transportation of Dangerous Goods Regulations Part 12.12 – Aerial Work and the Wyssen Avalanche Tower LS12-5 G3 Instruction Manual (v 3.6, June 2016).

### 1.1 Location

The TCH crosses Three Valley Gap 19 km west of Revelstoke, BC, and is subject to significant avalanche hazard. Avalanche paths are located on north facing, steep forested slopes that have no runout prior to reaching the highway. Small snowfall amounts can result in avalanches large enough to reach the highway and affect vehicles, thus frequent avalanche control is required. The TCH has an average daily traffic volume of approximately 3200 vehicles per day, with commercial vehicles representing a significant portion of this traffic. Traffic volume can be substantially higher during weekends and holidays.

## 2.0 Equipment for Blasting

The WAT system components and the equipment used for the assembly, loading and transport of the explosives and tower deployment box are listed below. Further detail of the system components can be found in the WAT Instruction Manual, Wyssen Avalanche Control (2016).

### 2.1 System Components

- Wyssen Avalanche Tower LS12-5 G3.
  - The tower deployment box (Figure 1).
  - The complete Wyssen Avalanche Tower (Figure 2).
- Wyssen Helicopter Latch HK-02 (Figure 3).
- Web-enabled device (PC, notebook, tablet, smartphone)
- WAC.3 base for radio communication with avalanche tower

### 2.2 Explosive Charge Components (Materials Per Charge)

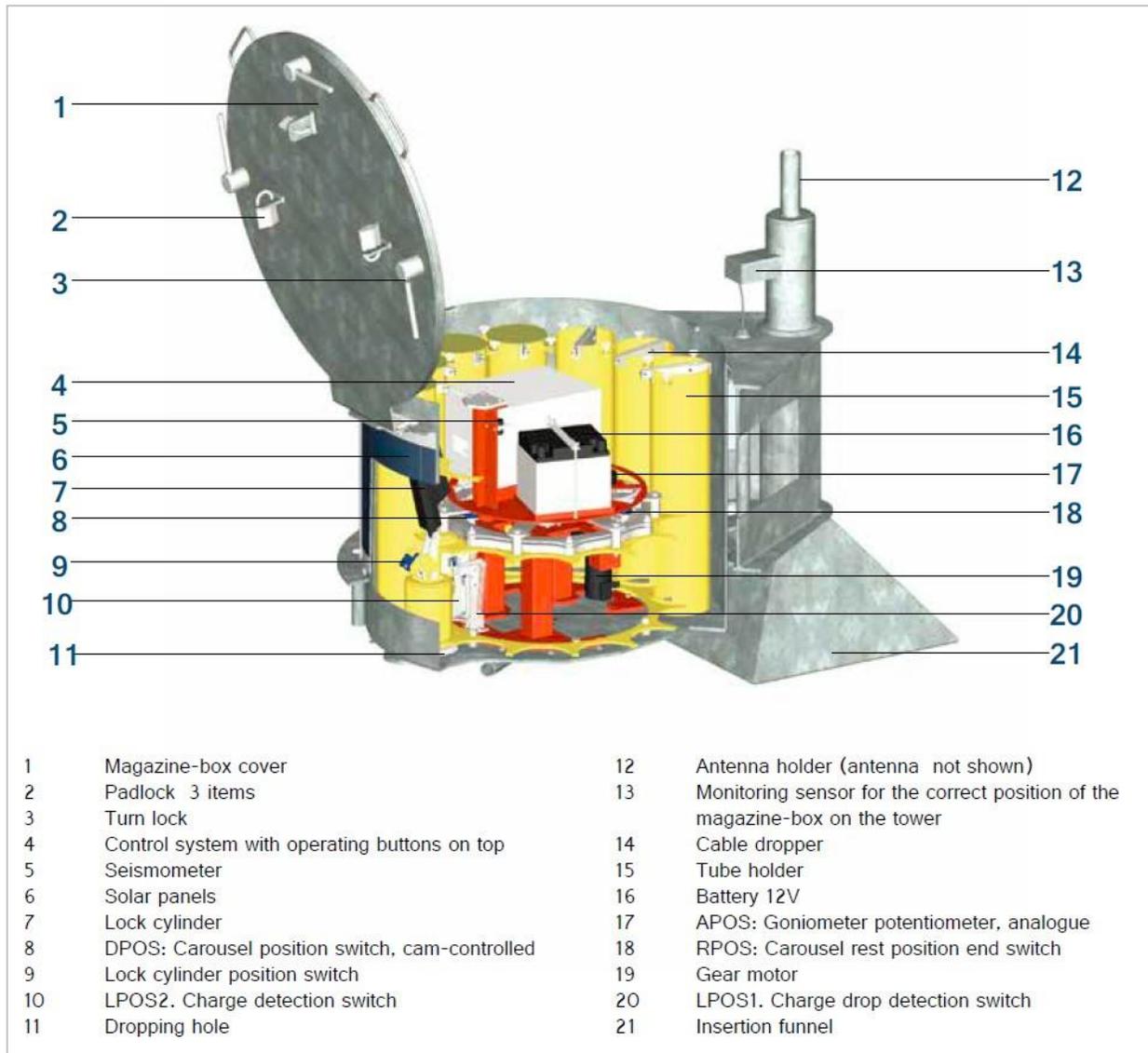
- Explosives: Dyno TX, 50 mm x 400 mm (0.96 kg), 4 units (total 3.84 kg).
- Safety fuse assemblies, 30 cm (variance, October 2016), 2 units.
- Wyssen percussion fuse lighters, 2 units.
- Wyssen charge container, 1 unit.
- Cord, 3 mm, approx. 7.5 m in cord sack for charge suspension, 1 unit.
- Wire hooks for connecting pull wire lighters to cord, 2 units.
- Retaining ring to connect suspension line to the cable dropper, 1 unit.
- RECCO reflector, 1 unit.

### 2.3 Accessory Tools

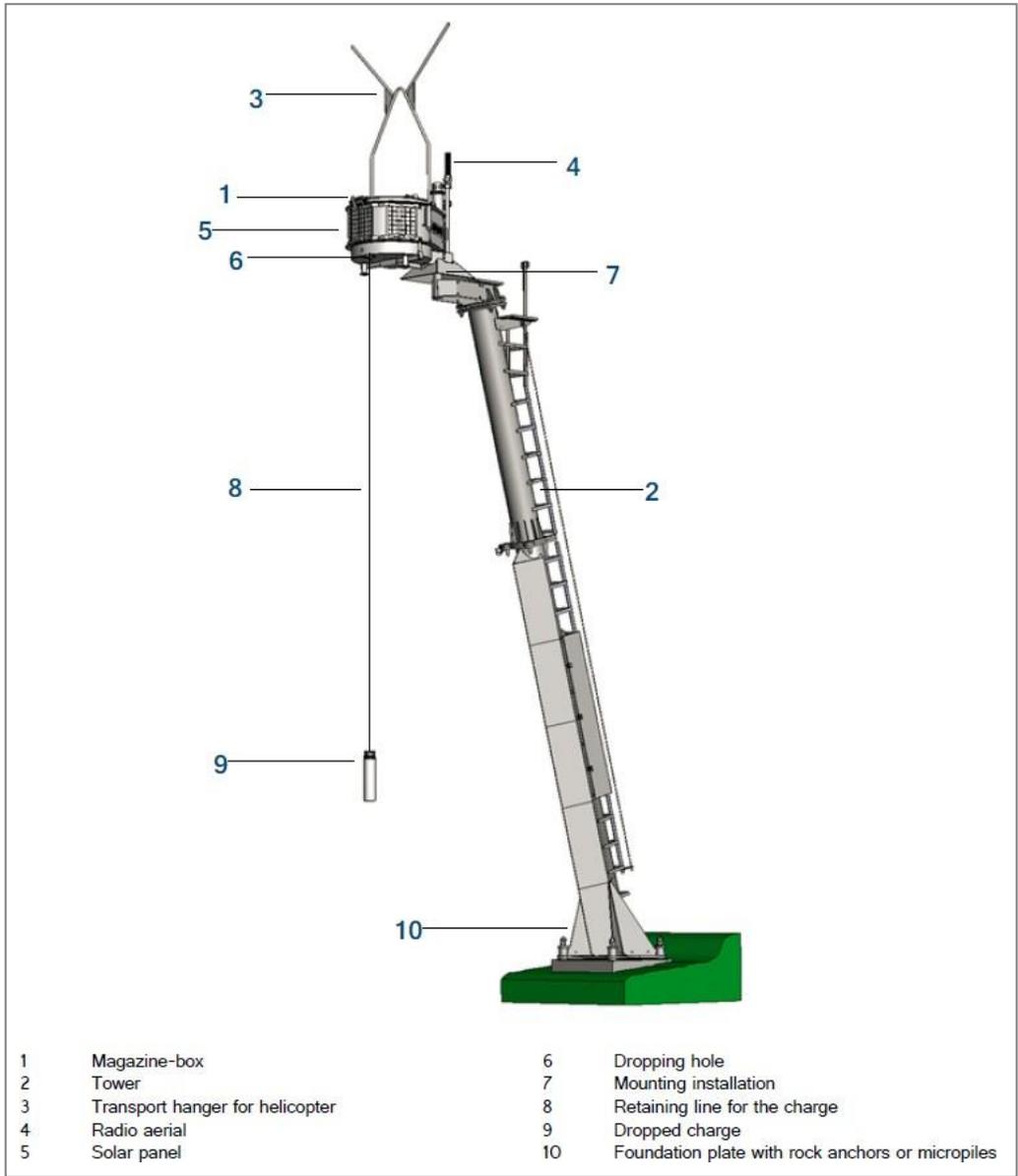
- Fuse cutters.
- Punch tool.
- Electrical tape.
- Eye protection.
- Gloves

### 2.4 Other

- Portable radio(s)
- Keys for WAT deployment boxes and control unit.
- Locks for WAT deployment boxes
- Container for safety fuse assemblies



**Figure 1.** Components of the tower deployment box.



**Figure 2.** Components of the complete Wyssen Avalanche Tower system.



**Figure 3.** Wyssen Helicopter Latch HK-02.

## 3.0 Documentation

Inspection, testing, maintenance, loading, and use of the Wyssen Avalanche Towers will be carried out in accordance with the manufacturer's recommendations and following the standard procedures outlined in the WAT Instruction Manual, including recommendations for:

- Charge construction.
- Loading and unloading the deployment box with explosive charges.
- Transport of the deployment box by helicopter.
- Seasonal recommissioning and decommissioning; and
- Maintenance.

The maintenance section of the manual includes inspection and maintenance instructions, maintenance schedule, and procedures in case of a malfunction. The supplier provides a 24-hour telephone service in the case of a system malfunction.

Records of inspections, pre-season and post-season maintenance, and testing will be maintained. A copy of the Avalanche Safety Plan, WAT Instruction Manual, and Explosive Use Procedures will be kept at the work site and made available to technicians using the system.

## 4.0 Personnel Roles and Responsibilities

### 4.1 Training and Certification

Personnel performing charge assembly will also be trained in:

- Site orientation.
- WHMIS training.
- TDG certification.
- WorkSafe BC blasting certificate for avalanche control.
- Wyssen Avalanche Tower specific training provided by an authorized Wyssen representative, covering the following topics:
  - System components, including maintenance and function tests.
  - Communication system operation and tests.
  - Pre-season maintenance requirements.
  - Charge assembly and loading.
  - Aerial transport operations.
  - Misfire procedures; and
  - Post-season decommissioning.

## 5.0 Operational Procedures

The operational procedures are presented in three sections for each of the following periods of use: recommissioning the system at the start of the season, operational use, and decommissioning the system at the end the winter season. Personnel performing the tasks described below will meet the training and certification requirements list in Section 4.1 of the procedures. A Blaster of Record will be designated for explosive charge assembly, loading, helicopter transport of the deployment box, testing and operations.

### 5.1 Pre-Season Commissioning

Prior to the start of each winter season, several tasks are required to prepare the system for use. This includes inspecting all system components, assembling the explosive charges, loading the deployment boxes, and transporting the deployment boxes to the towers.

The charge assembly and loading area will be least 400 m from inhabited areas and publicly travelled roads. This area will be secured during arming of the system to prevent unauthorized access.

#### 5.1.1 Preparation of the Deployment Box

1. The docking system spike on the tower is to be cleaned and greased. Smooth out any irregularities, burrs, or edges with a coarse file. Apply a thick layer of waterproof and low temperature grease to the spike (grease brand/properties approved by Wyssen).
2. The battery (ies) on the deployment box are charged with a voltage of 12.8 V.
3. Position the deployment box to ensure that there is not more than 30 cm of free height below the bottom of the deployment box (deployment hole).
4. Prior to loading, each deployment box is located such that it is moved less than 50 m to the helicopter attachment point.
5. Open all padlocks on the cover and turn the locking level through 90°.
6. Lift the cover using handles provided until the safety catch engages. This is a two-person task due to the heavy weight.
7. Set all sliders of the cable droppers into the rear position.
8. Unfasten the hand screws of the tube holder cover and remove the cover.
9. Remove cable droppers from their notches.

## 5.1.2 Explosive Charge Construction

1. Preparation of the charge container:
  - a. Place a RECCO reflector on the inside of one of the plastic half shells, between the ribs.
  - b. Insert the explosive cartridge(s) into one half of the plastic shell. Ensure the cartridge(s) sits at the bottom end of the plastic shell.
  - c. Snap the second half of the plastic shell together with the first one, starting with the tabs at the bottom of the shell working upwards.
  
2. Preparation of the retaining cord:
  - a. Guide the retaining cord through the four holes on the top end of the plastic shell join the two ends with a Flemish bend (Figure 8 Knot).
  - b. Release the cord attached to the back of the pre-assembled cord sack and then fasten the sack with a girth hitch to the retaining cord.
  - c. Clip the spring hooks into the eyelets of the percussion fuse ignitor and insert the cord sack with the end (ring) on top.
  - d. Place the foam stopper on the top of the cord sack to protect and secure the inserted retaining cord and percussion fuse ignitor.
  
3. Preparation of the safety fuse:
  - a. Prepare the safety fuse assemblies with approved tools by cutting the fuse to a length of 30 cm.
  
4. Priming of the charge:
  - a. Loosen the screw sleeves at the bottom of the percussion fuse ignitors by approximately 1 turn and remove the plug. Do not unscrew completely. Hold the ignitor at the top with one hand to prevent twisting. **NOTE: If the ignitor should be completely unscrewed, do not reassemble; this ignitor must not be used.**
  - b. Push the free end of the safety fuse assembly fully up into the ignitor and firmly tighten the screw sleeve (compression fitting). Hold the ignitor by the lug with one hand while tightening the screw sleeve to prevent twisting. Repeat for the second safety fuse assembly.
  - c. Pierce explosive cartridge(s) with the punch tool through the side holes in the plastic shell and insert the detonator on the safety fuse assembly securely into the cartridge. Repeat for the second safety fuse assembly.
  - d. Clip the safety fuse assemblies into the plastic clips on the inside of the plastic shell.
  
5. Securing the primed charge:
  - a. The primed charge is placed and secured in the temporary storage rack.
  - b. A quality control inspection is conducted for each charge by a second trained person, completely independent of the construction process. This inspection will confirm the charge is assembled correctly following the procedure described above.

### 5.1.3 Loading the Deployment Box with Explosive Charges

1. Bring the prepared explosive charge to the deployment box and set it down on the surface next to the flashing light. The prepared charges should never be handled or transported one-handed.
2. Carefully remove the foam stopper from the charge while ensuring the retaining cord stays in place.
3. Take hold of the explosive charge on the inside of the plastic shell through the holes at the upper edge of the tube and carefully insert the charge into the tube holder, beginning with Tube #12 and working in descending order.
4. Attach the ring on the end of the retaining cord to the cable dropper by inserting the ring into the center slot on cable dropper and push the slider to the front extended position, which holds the ring. The slider goes into the front position by pressing the metal pin at the bottom of the cable dropper.
5. Lay the cable dropper into the notches of the tube holder so that the ball bearings point to the center of the deployment box. Both recesses in the cable dropper must lie within the tube holder to prevent the cable dropper from shifting.
6. Ensure the retaining ring is correctly mounted in the cable dropper. After this check, avoid touching the cable dropper.
7. Replace the tube holder cover and tighten the hand screws.
8. Conduct a test run with the switches on the control system (per section 5.1.4).

### 5.1.4 Test run with Operating Buttons

Prior to transporting the unit, a test run is carried out using the operating switches on the control system. The display serves to indicate important information about the system.

1. Pull out the emergency stop master switch until the yellow marking is visible.
2. Press the test button until the hourglass on the display switches off again (5 seconds). The flashing warning triangle signals test operation.
3. Press the start button until the hourglass on the display turns off again (2 seconds).
4. The test run now proceeds automatically and lasts about 8 minutes, depending on the number of charges.
5. When the warning triangle switches off, the test run has been successfully concluded. **Do not switch off the control system or carry out another test run prior to transportation.**
6. Once the system test is completed, close the deployment box, attach the padlocks, and prepare for transportation.

## 5.2 Transportation of the Deployment Box by Helicopter

The transportation of the deployment box by air is regulated by Transport Canada and the Transportation of Dangerous Goods Directorate. Personnel performing the tasks

described below will meet the training and certification requirements list in Section 4.1 of the procedures.

The Wyssen deployment box is a small means of containment designed and secured to prevent the accidental release and detonation of the explosives during transport. Further safety measures are described in the procedures below to minimize risk to workers and the public.

The helicopter loading area and flight corridor will be least 400 m from inhabited areas and publicly travelled roads. This area will be secured to prevent unauthorized access during the arming process. If the flight path requires that a publicly travelled road be crossed, specific procedures must be developed in accordance with WSBC OHS Part 18

### **5.2.1 Pre-planning for Helicopter Transportation**

1. The pilot-in-command is provided with written information for each of the dangerous goods being transported, including:
  - a. The shipping name, UN number and class; and
  - b. The net explosive quantity (NEQ).
2. The pilot-in-command and ground crew review the operational procedures, operation of the load-carrying equipment, the flight plan, dangers when flying external loads, and emergency procedures in addition to the standard pre-work tailboard (safety) meeting.
3. A long-line with an automatic electrical latch is used for transporting the deployment box. The helicopter company is responsible for ensuring good working condition of all load-bearing elements. The elements must be designed to carry loads of at least 700 kg.
4. No passengers are allowed in the helicopter during transportation of the deployment box.

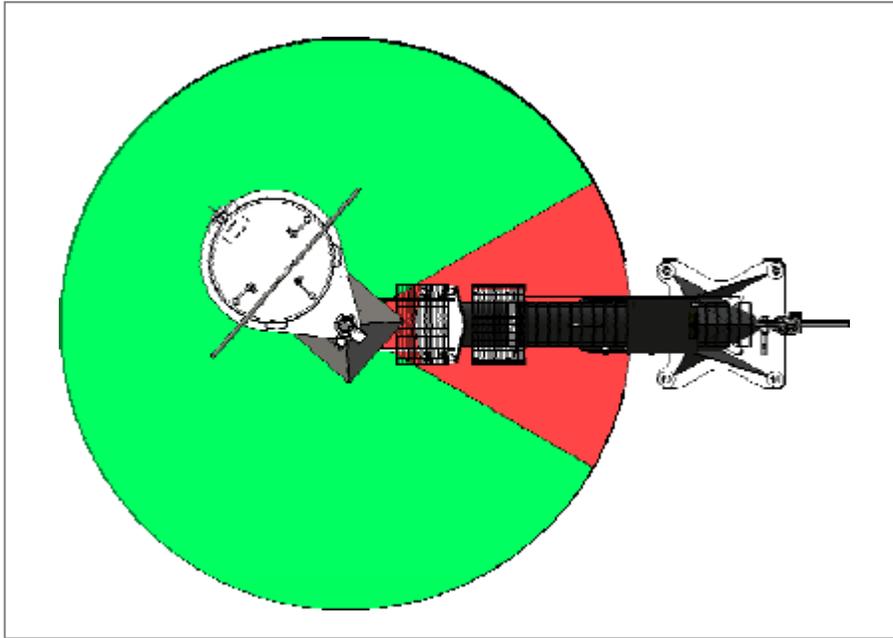
### **5.2.2 Helicopter Attachment**

1. In addition to the 400 m distance requirement, the staging area/receiving point of the loaded deployment box must be suitable for helicopter operations with appropriate approach and departure corridors.
2. Ensure weather conditions are suitable for helicopter operations.
3. The ground staff must wear an approved helmet or hardhat with chin strap, safety glasses, high visibility vest, gloves, suitable clothing, and solid footwear.
4. No use of the Wyssen Avalanche Control Centre software is allowed during transportation of the deployment boxes. Use of the software is only permitted after the deployment box has been placed on the tower and the helicopter has left the danger area.
5. The Blaster of Record is responsible for a final check of each deployment box prior to transport to ensure the charge-dropping mechanism is on stand-by and the latch, padlocks and dropping hole are closed and secure.

6. During the approach to the receiving point, the pilot must establish contact with the ground staff as a communication check. If this attempt fails, the helicopter must land, and the malfunction rectified prior to transportation.
7. The electric latch is connected directly to the transport hanger of the deployment box.
8. After attaching the deployment box to the helicopter, no persons can be under the suspended load.

### **5.2.3 Placement of the Deployment box on the Tower**

1. The pilot brings the insertion funnel directly over the docking spike on the top of the tower, following the range of permitted approach angle in Figure 4.
2. As the deployment box is lowered onto the docking spike, the deployment box will automatically turn into the correct alignment. A flashing light on top of the deployment box blinks for 1 minute as soon as it is correctly positioned.
3. If during the positioning maneuvers, the deployment box hits the tower heavily or is positioned roughly, the internal mechanism may be damaged and the pilot should not release the latch and must return the deployment box to the staging area for a test run.
4. Once the pilot confirms the deployment box sits firmly on the docking spike and is correctly positioned; the latch can then be released.
  - a. In the case the deployment box is released but not positioned correctly (i.e. no flashing light), the deployment box must be retrieved using the HK-02 latch and returned to the staging area.
5. After positioning of the deployment box, a test run is conducted. The test must only be started after the helicopter has left the danger area around the avalanche tower.
6. Once all deployment boxes have been placed, a flight with a second trained person will be done to confirm each deployment box is placed on the correct tower.



**Figure 4.** Range of permitted approach angle when placing the deployment box on the tower.

### **5.3 Live Testing and Operational Use**

#### **5.3.1 Area Closure**

An area closure will be implemented as described in Section 3.2 Closures of the Dynamic Avalanche Consulting Ltd. General Explosive Use Procedures for Avalanche Control. For publicly travelled roads, the closure will also be in accordance with WSBC OHSR Part 18 and the managing agency of the roadway (e.g. BC Ministry of Transportation).

The general sequence of events from initiating the closure to re-opening the area following explosive control will be as follows:

1. Initiate the area closure.
2. Proceed to a safe firing location.
3. Ensure that the closure is effective, and the danger area is clear.
4. Use the firing control system (Section 5.3.2) to control the selected WAT on the selected target.
5. Confirm detonation of the WAT using one or more of the following means: system detection by geophone, acoustically, visually.
6. Misfire check.
7. Record the results.
8. Repeat steps 4 through 7 for the next target(s).
9. Notify closure control personnel that blasting has been completed.

### 5.3.2 Firing the System

The Wyssen avalanche towers are controlled using a web application (control.wyssenavalanche.com) to access the firing system. Individual login credentials and a code list are used to maintain a high standard of safety and security. The entry of login credentials and a single-use numeric code from the code list is required prior to accessing the firing system. The firing system communicates with the towers via an encrypted radio communication system.

To fire the system:

1. Load the web application and enter your login credentials.
2. Enter the 8-digit numerical code.
3. The firing system is now activated until a charge is deployed, or until the time-out limit of 15 minutes is reached.
4. After deploying the charge, detonation must be confirmed. Detonation can be confirmed in three ways:
  - a. Automatic detection by the geophone and displayed in the firing system.
  - b. Acoustically.
  - c. Visually.
5. The firing system will display a "Closed and Secure" status for the tower, indicating that dropping hole is sealed and the firing system connection is terminated.

### 5.3.3 System Malfunctions

If a fault occurs during the firing sequence, it is treated as a misfire the misfire procedures in Section 5.3.4 are followed. The Wyssen Avalanche Control 24-hour support line should be contacted immediately.

### 5.3.4 Misfire Procedure

If a misfire has occurred and is not recovered or disposed of before another shot is used to reduce the avalanche hazard, all miss fire protocols must be followed before snow removal along the highway can take place. As per the WSBC Variance VR201600107 in Appendixes.

A misfire occurs when detonation cannot be confirmed by any of the three methods described in Section 5.3.2. Four types of misfires can occur (Type A1, A2, B1 and B2). Type A misfires are those which are hanging on the cord and Type B misfires are those which are lying in the snow. All types of misfires will be handled using the following procedures:

1. Maintain the area closure.
2. Observe the minimum waiting period of 30 minutes before approaching the danger, either by foot or in a helicopter.

3. Locate and visualize the misfire. This may require the use of a helicopter for towers that are difficult to access. Consider that misfires could potentially slide away from the tower and may have the potential to trigger an avalanche and be carried downslope to highway elevation.
4. Under no circumstances may a deployment box be transported beneath a helicopter with a suspended misfire.
5. If a cord is found in a misfire, it must not be pulled since this can activate the percussion fuse lighter and detonate the charge.
6. A misfire must not be moved. If the charge contains a safety fuse and is re-blasted, the workers must not return to the blast site for 30 minutes after detonation.
7. For both Type A and B misfires, confirm the wire hooks are evident on the cord, which confirms the percussion fuse lighter was activated. If the wire hooks are not evident (i.e. still attached to the percussion fuse lighter), the percussion fuse lighter may not have been activated and extra caution is required.
8. For Type A misfires, remotely release the charge retaining cord from the deployment box.
9. Once the misfire is on the snow surface (Type B) or already on the surface (Type B), deploy a conventional explosive to detonate or destroy the misfire, as per the helicopter control or hand charging misfire procedure.
10. Confirm the detonation and perform a post-blast inspection to confirm the misfire was destroyed.

## **5.4 Post-Season Decommissioning**

During the summer, it is preferable to house the deployment boxes in secure, dry storage. Explosive charges that have not been used are preferably detonated prior to deployment box removal, but if this is not possible (e.g. malfunction of the deployment box), the charges must be removed from the deployment box and destroyed as the safety fuse must not be disassembled.

### **5.4.1 Return Transportation of the Deployment box by Helicopter**

The Wyssen helicopter latch is attached to the automatic electrical latch on the long line to retrieve the deployment box.

The Wyssen helicopter latch must be regularly inspected and tested for proper functioning and damage prior to each transport of the deployment box as follows:

- The latch must be free to move upwards as far as the stop.
- The latch must drop and close independently through its own weight.
- In the closed state, the notch of the latch must lie on top of the supporting bolt.
- No cracks shall be visible on the latch or handle; and
- The latch and the handle must not be deformed.

If any defects are found or if there are any uncertainties, the helicopter latch in question must not be used.

The Wyssen helicopter latch is used for the return transport of the deployment box only. This allows the attachment of the deployment box to the helicopter longline without the assistance of ground personnel. Under no circumstance may the latch be used for the lifting of other loads. During the lifting of the deployment box, no personnel are permitted to be on or near the tower.

The following procedure is used to retrieve the deployment box from the tower.

1. The pilot then flies over the deployment box and lowers the Wyssen helicopter latch over the fork of the transport hanger on the deployment box. Once lowered far enough, the latch on the Wyssen helicopter hanger will catch the transport hanger and secure the deployment box to the helicopter longline.
2. As the pilot lifts the deployment box off the tower, they must ensure that they are lifting vertically to ensure that they do not cause damage to the tower.
3. As soon as the deployment box is lifted off the tower, the monitoring switch automatically deactivates the power supply to prevent an accidental release of a charge, should charges remain in the deployment box.
4. The deployment box is transported to the staging area and set down carefully.
5. The deployment box must be resting on the ground and the helicopter longline not under tension prior to uncoupling. The latch must only be opened by the black lever on the Wyssen helicopter hanger by ground staff.
6. Once the deployment box is released, the pilot is signaled so they can depart.

#### **5.4.2 Unloading Explosive Charges from the Deployment box**

If the deployment box is returned to the staging area with explosive charges still inside, the following steps are followed when unloading:

1. Open all padlocks on the cover and turn the locking level through 90°.
2. Lift the cover using handles provided until the safety catch engages. This is a two-person task due to the heavy weight.
3. Press the emergency stop master switch to ensure the system is deactivated and to protect the batteries during summer storage.
4. Activate all sliders on the cable dropper by pressing the side of the ball bearings toward the back.
5. Ensure the retaining ring is disengaged from the cable dropper.
6. Remove the cable dropper from the tube holder.
7. Take hold of the charge through the holes at the top of the plastic shell and lift out of the tube holder.
8. The primed charge is placed and secured in the temporary storage rack until the blaster is prepared to destroy or disassemble the charge.

9. Close the deployment box.

### 5.4.3 Charge Disassembly

1. Loosen the screw sleeves at the bottom of the percussion fuse ignitor by one turn.
2. Remove the both safety fuse assemblies from the percussion fuse ignitors through the openings on the side of the plastic shell.
3. With a slow, smooth, and even pressure, remove both safety fuse assemblies from the charges. If resistance is encountered, the charge should not be disabled and must be destroyed in an appropriate safe location using the misfire procedure.
4. The safety fuse assemblies may not be reused if disassembled.
5. If the explosive charges are going to be stored in the plastic shells for future use, the plugs must be inserted into the bottom of the percussion fuse ignitors to protect them from moisture.
6. If the explosives are being stored for future use, the expiration date should be noted and must not be exceeded during subsequent use.

### 5.4.4 Preparing the Deployment box for Storage

To ensure that the battery survives the summer without any damage, it should be completely charged prior to being placed in storage. Connect the battery to the charger for at least 24 hours. The battery must only be charged with a designated battery charger which has temperature-controlled charging voltage. Battery chargers such as those used for car batteries are not suitable and damage the battery.

## 5.5 Emergency Procedure - Dropped Deployment box

In the unlikely event the deployment box is dropped during helicopter transport, it will be known to the Blaster of Record whether the deployment box contains explosives. If it does not, then a plan can be put in place to safely recover the deployment box. If the deployment box does contain explosives, the following procedure is followed by the Blaster of Record:

1. **Dial 911** to activate required emergency services (police, fire and/or ambulance).
2. Begin evacuation of the area around the deployment box to 1600 m in all directions.
3. Contact the following:
  - a. Local RCMP Detachment (detachment listings can be found here: <http://www.rcmp-grc.gc.ca/detach/index-eng.htm>);
  - b. Emergency Management British Columbia (PEP) **1-800-663-3456** (24 hours)
  - c. Regional Transportation Management Centre **1-866-706-7862** (24 hours)
  - d. Explosive technical advisors as necessary (Dyno Nobel Inc.).
  - e. Wyssen Avalanche Control Inc. (Switzerland) **+41 79 628 1083**

- f. Notify Explosives Regulatory Division – Pacific Region **604-666-0366**<sup>1</sup>.
  - g. Notify WorkSafe BC **1-888-621-7233**.
- 
- 4. Assist the Emergency Response Personnel (Incident Commander and/or Task Force Team Leader), in the role of Technical Advisor to recover and disposed of explosive products safely and efficiently.
    - a. Assess explosive division type(s), quantity, and conditions at the accident site to determine minimum evacuation distance.
    - b. Arrange for the delivery of explosives clean up materials and equipment as necessary for the severity and extent of spilled explosives.
    - c. Confirm with Incident Commander and/or Accident Site Commander that assistance from outside agencies (e.g. RCMP, EMBC and CANUTEC) has been requested and dispatched as necessary. Ensure that essential personnel only are involved in the transfer and clean-up of spilled explosive products to minimize risk.
    - d. In consultation with external expertise (e.g. Wyssen, Dyno Nobel, WorkSafe BC), advise the Incident Commander and/or Accident Site Commander of the most appropriate actions to ensure safety of all personnel involved.
    - e. Liaise closely with the Incident Commander and/or Accident Site Commander and outside agencies at the accident site (e.g. RCMP) to ensure that all decisions made reflect the utmost concern for safety of involved personnel.
    - f. Ensure that the area has been thoroughly searched to confirm that all spilled explosive materials have been removed prior to re-opening the evacuated area.

## 6.0 Closure

These procedures have been developed for use by Dynamic Avalanche Consulting Ltd. with the Wyssen Avalanche Tower (WAT).

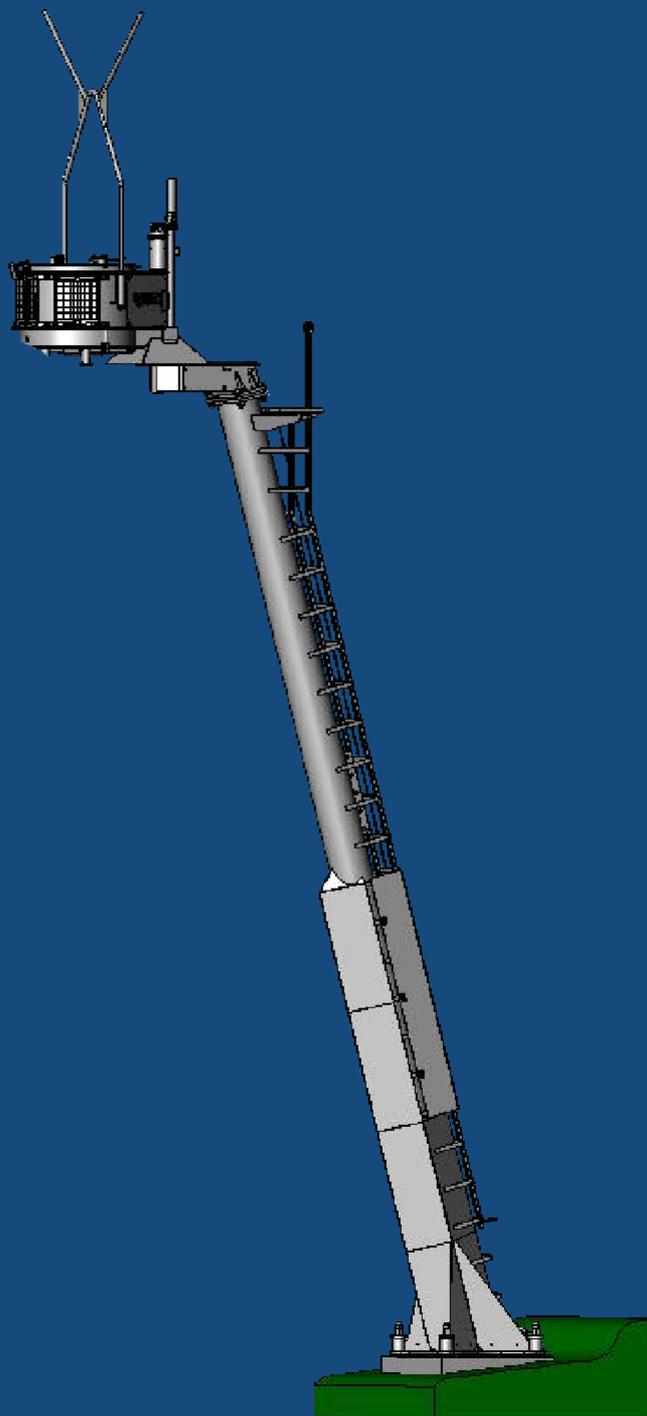
They describe blasting equipment used with the WAT, personnel training, the assembly and loading of explosives in the tower deployment box, flight operations for the helicopter transport of the tower deployment box, deployment of the explosives using the remote system and misfires. Procedures are in accordance with WorkSafe BC (WSBC) Occupational Health and Safety Regulations (OHS Part 21 – Blasting Operations and Part 29 - Aerial Operations, Natural Resources Canada Explosive Regulations, Transportation of Dangerous Goods Regulations Part 12.12 – Aerial Work and the Wyssen Avalanche Tower LS12-5 G3 Instruction Manual (v 3.6, June 2016).

These procedures will be reviewed annually and if any changes are made, they must be approved in writing by WorkSafe BC.

# Instruction Manual (original)

Wyssen Avalanche Tower LS12-5 G3

Wyssen Helicopter Latch HK-02



Snow is our element

Safety through technology is our strength





# Safety Information

This manual contains information that must be observed for your personal safety, the safety of other persons and for the prevention of material damage. Such information is highlighted by a warning triangle and displayed depending on the degree of risk in the following manner.

**Danger**

Danger indicates that death or severe bodily injury will occur if the corresponding safety measures are not taken.

**Warning**

Warning indicates that death or severe bodily injury can occur if the corresponding safety measures are not taken.

**Caution**

Caution with a warning triangle indicates that mild or moderately severe injury can occur if the corresponding safety measures are not taken.

**Caution**

Caution without a warning triangle indicates that material damage can occur if the corresponding safety measures are not taken.

**Tip**

Indicates useful or necessary user information.

## Qualified Personnel

Personnel operating the WysseN avalanche towers or the WysseN helicopter latch must be officially appointed by the company management. Furthermore, the staff must also possess personal certification of training on the installations carried out by the manufacturer as well as a nationally valid licence for the artificial release of avalanches with explosives for operating the avalanche tower.

Instructions by colleagues within the company are not valid as a replacement for the installation training by the supplier. Persons who have not been trained by the supplier and who do not have the above-mentioned certification may not operate this installation.

If required, refresher training courses from the supplier may be requested at any time by the operator of the installations.

## Intended Use

The avalanche tower is designed to trigger controlled avalanches by blasting. This is to safeguard avalanche-endangered installations, ski slopes, buildings, transport routes etc. where uncontrolled avalanches could lead to injury or damage to persons or property.

The intended use of this equipment is solely for the controlled release of avalanches and may only be operated by trained personnel in accordance with the regulations and after precise assessment of the current situation with regard to residual risks.

The installation is only to be used in conjunction with other devices and components that are recommended or approved by WysseN Avalanche Control AG.

The proper and safe operation of the product requires correct transportation, assembly, storage as well as careful operation and maintenance.

# Introduction

The objective of this instruction manual is to provide the user with complete information and all necessary details in order to use the installations safely and properly.

This instruction manual is intended specifically for the personnel responsible for operating and maintenance, and who have the appropriate qualification and training with the corresponding permit.

Preparation of the foundation and also assembling or dismantling the tower will be described in separate documentation, that is intended for the responsible engineers and the personnel carrying out the construction.

The recommended FOM supplement given in the Annex is intended for helicopter companies that carry out flights transporting the avalanche tower magazine-boxes. In order to carry out the order, these must get approved by the State Aviation Authority with the FOM supplemented with this specific operational procedure.

The present instruction manual must be carefully read and understood prior to commissioning the installations and must be on hand at all times during operation and maintenance of these. If, for any reason, this document should no longer be available or becomes illegible, it is imperative that a new document be immediately requested or made available.

Separate courses and literature are necessary in order to be able to make an in-depth analysis of the on-the-spot avalanche situation.

## Service & Support on the Internet

In addition to this documentation, we also offer our expertise online under the following link:

[www.wysseavalanche.com](http://www.wysseavalanche.com)

You will find the following useful information under these addresses:

- ( product-specific details
- ( remote maintenance tool download
- ( newsletter with current information about our products
- ( information about repairs, replacement parts, service etc.
- ( e-learning about the Wyssen avalanche tower LS12-5

# Technical Support

A technically qualified support team is globally available for you at all times if you have questions and problems.



Switzerland	Austria	Norway
Tel: +41 79 628 10 83	Tel: +43 664 460 30 10	Tel: 971 23 582
E-Mail: <a href="mailto:service.ch@wyszen.com">service.ch@wyszen.com</a>	E-Mail: <a href="mailto:service.at@wyszen.com">service.at@wyszen.com</a>	E-Mail: <a href="mailto:service.no@wyszen.com">service.no@wyszen.com</a>

Canada	Chile
Tel: +41 79 628 10 83	Tel: +41 79 628 10 83
E-Mail: <a href="mailto:service.ca@wyszen.com">service.ca@wyszen.com</a>	E-Mail: <a href="mailto:service.cl@wyszen.com">service.cl@wyszen.com</a>

## Certifications



The Wyszen Avalanche Control avalanche tower LS12-5 (Art. no. 411.100B) conforms to the relevant provisions of the CE-machine directives (CE-directive 2006/42/EG and 2004/108/EG), including their changes, and also to the corresponding legislation for implementing the directive into national law.

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# 1 Description of the Installation

The Wyssen avalanche tower is designed for the controlled release of avalanches with remote-controlled blasting. It can be used to safeguard avalanche-endangered installations, ski slopes, buildings, roads etc. where uncontrolled avalanches could lead to injury or damage to persons or property.

To trigger an avalanche, a command is given by a wireless connection from the command centre to the control system of the magazine-box to initiate blasting.

The magazine-box contains 12 prepared explosive charges, which can be individually dropped.

When the explosive charge is dropped, two percussion fuses are pulled and the explosion is set off after a time delay.

The charge remains hanging from a cord at a pre-set height above the snow surface, which is completely dropped following blasting. To reload the explosive charges, the complete magazine-box is lifted from the tower by a helicopter and brought to a station building.

Besides the charge dropper function, a system test, a so-called test run, can also be carried out. The test run serves as a function check of the entire mechanism and control system in the magazine-boxes as well as determining whether explosive charges have been removed by theft.

## 1.1 Advantages

### Smallest residual risk thanks to the greatest sphere of action

(Blasting above the snow with larger charges (4.5kg) gives

the maximum sphere of action up to 260m in diameter

(Explosives with a high-frequency N-shaped pressure wave have been proven to lead to the best release effect, particularly at a greater distance from the detonation point

(The possibility of positioning the installation in higher locations in addition to suspending the charge higher enables the effect to be reached in pressure shadow locations (in couloirs, behind terrain ribs)

(Release of the smallest quantities of snow is possible thanks to its high effectiveness

(Very good stability test for assessing the local avalanche danger

### Maximum reliability

(No critical or moving parts are exposed to the weather, thanks to its intelligent concept

(The solar power supply or wind generator avoid the necessity of vulnerable supply lines in the terrain

### Reduced closure times thanks to rapid release, around the clock and in all weathers

(remote-controlled installations allow operation around the clock

(very rapid operation possible

(closure times are reduced to a minimum

(clearing away avalanche snow is usually dispensed with, since the avalanche run-outs are short due to the release of smaller portions

### Highest cost-effectiveness

(low investment and operating cost in comparison with permanent constructional protective measures

(minimal operational costs thanks to its ingenious system concept

(damage to the infrastructure is avoided by the release of smaller portions

(economic benefits thanks to reduced closure times

### Highest degree of safety for the operating staff

(thanks to remote-controlled release, no staff in the danger area

(preparation of the charges takes place in protected areas

(the mobility of the magazine-box means that no maintenance is necessary in the terrain

### The smallest interference in nature is very environmentally friendly

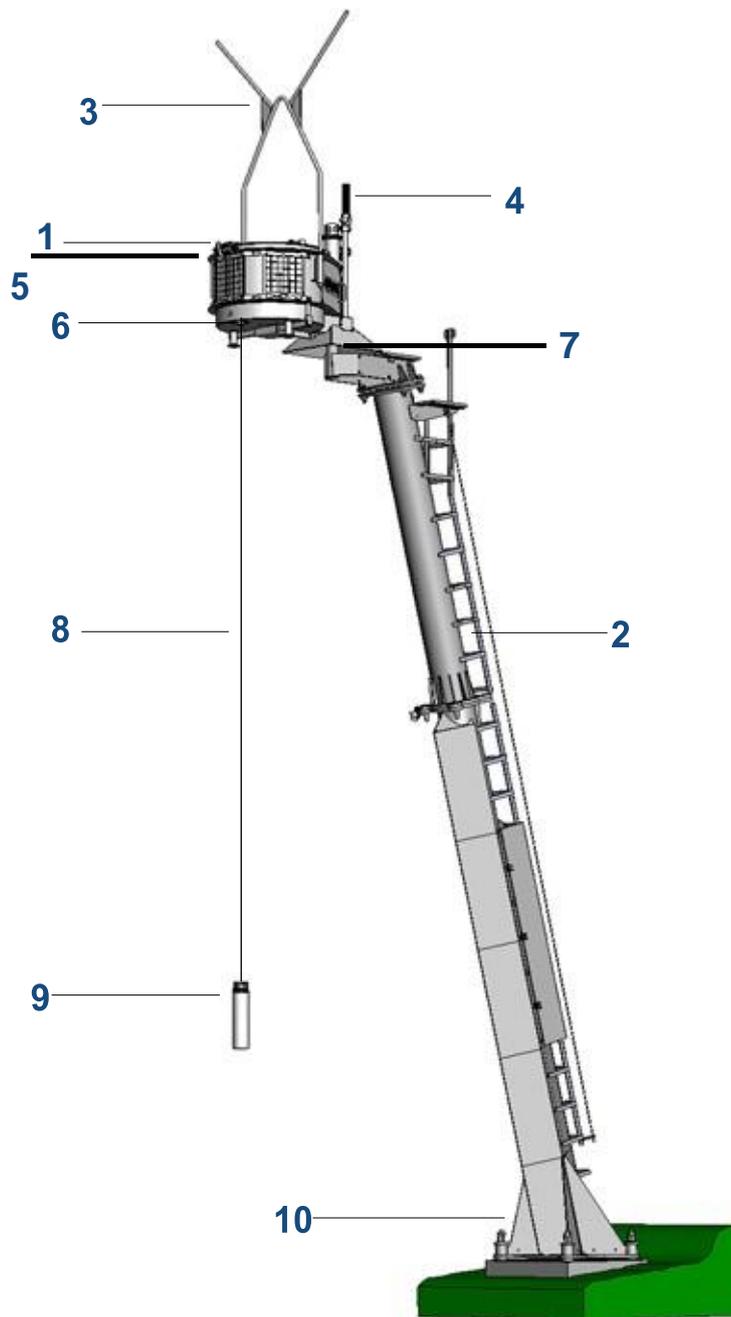
(foundation only requires 1 m<sup>2</sup>

(short construction times in the terrain simplify planning and implementation

(blasting over the ground prevents damage to the vegetation cover

(dismantling after operating life possible without any problems

## 1.2 Construction of the complete installation



- |   |                                 |    |  |
|---|---------------------------------|----|--|
| 1 | Magazine-box                    | 6  | Dropping hole                                    |
| 2 | Tower                           | 7  | Mounting installation                            |
| 3 | Transport hanger for helicopter | 8  | Retaining line for the charge                    |
| 4 | Radio aerial                    | 9  | Dropped charge                                   |
| 5 | Solar panel                     | 10 | Foundation plate with rock anchors or micropiles |



## 1.3 Technical Data - magazine-box

### 1.3.1 General information

Description	Wyssen avalanche tower
Abbreviated designation	LS12-5
Weight of complete magazine-box unloaded	approx. 544 kg (up to 2008 approx. 620 kg)
Dimensions Magazine-box (l x w x h)	1600 mm x 1050 mm x 1200 mm
Protection class when magazine closed	IP43

### 1.3.2 Loading

Number charges per launcher	12 pcs.
Amount of explosives per charge	max. 4.5 kg

### 1.3.3 Energy supply

Battery in magazine-box supplied by solar panel	12V
---	-----

### 1.3.4 Data transmission

- ( EGSM 850 / 900 / 1800 / 1900 MHz
- ( GSM / GPRS Protocol stack 3GPP Release 4 compliant
- ( Transmission in concession-free data channels in the 430MHz or 868MHz range

### 1.3.5 Tower

Version	Standard height		
Typ N (normal)	8m	10m	12m
Typ V (reinforced)	8m	10m	12m

For detailed data about the tower, please refer to the foundation Instructions

### 1.3.6 Temperature

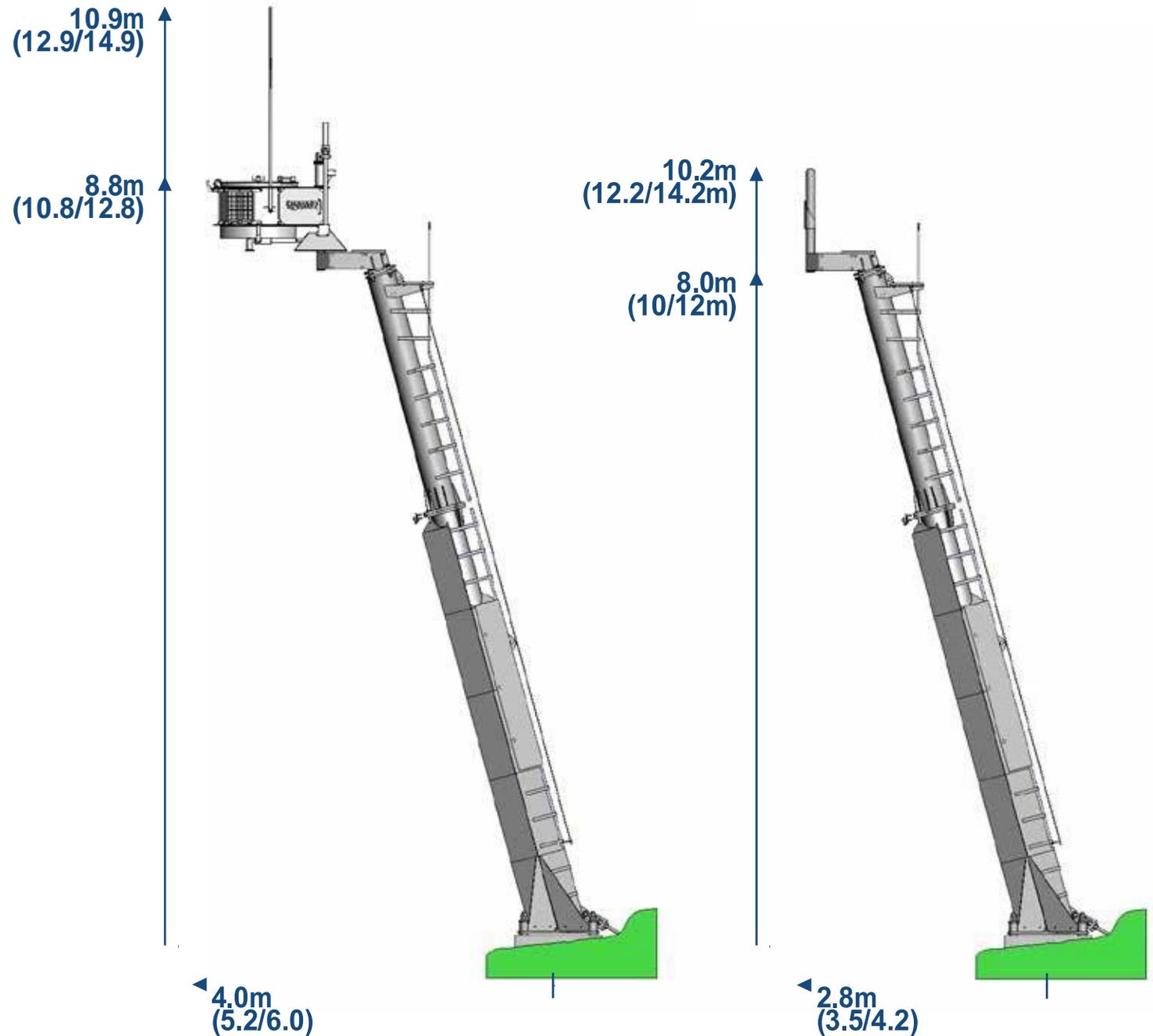
The permitted temperature range of the magazine-box extends from -20°C to +40°C.

Test runs and blasting may only be carried out when the temperature lies within this range.

## 1.4 Mass of avalanche tower

Tower in winter  
with magazine-box

Tower in summer  
without magazine-box



## 2 General Safety Regulations

### 2.1 Presentation of the safety notices

Safety notices about danger and warnings, prohibitions and requirements are identified by the following pictograms in the instruction manual and on the product.



Explosive materials warning



Corrosive substances warning



Warning of hand injuries



Observe instructions for use



Access for unauthorized forbidden



Starting of any fire prohibited

### 2.2 Principles



#### Warning

Incorrect operation, release of blasting at the wrong time or while there are persons in the danger area can have fatal consequences or cause material damage.

The installation described here conforms to the state of the art technology and to the recognised safety requirements. Nevertheless, dangers can arise, particularly when handling explosive materials and at the controlled release of avalanches. Therefore, care must be taken to ensure that the installation is in perfect condition and operated in compliance with the instruction manual.

The effective legislation in the country of use must be observed at all costs when handling explosives. This applies particularly for acquisition, transportation, storage, handling utilisation and destruction/disposal of explosives and pyrotechnic articles.

## 2.3 General information

Prior to commissioning, the present instruction manual must be read and the instructions contained therein must be strictly followed. In case of any ambiguity or product defects, contact the supplier immediately.



### Warning

Care must be taken that no operations are performed with the magazine-box as long as there are persons in the danger area.

This means that the whole of danger area 1 must be evacuated, cordoned off and secured by checkpoints prior to any manipulation involving a movement of the dropping mechanism in the magazine-box (blasting, test run). The exact rules of conduct prior to and during blasting must conform to the rules of blasting technology, in accordance with the instructions to get authorisation to artificially release avalanches by blasting. The regulations can be found in the explosives legislation of the respective country.

The danger area mentioned may only then be released for access by persons, if the avalanche fracture zone has been secured and regarded as being safe.

This cannot be definitely guaranteed with a blast from the avalanche tower described above. The avalanche danger must first be declared safe by a locally responsible avalanche expert before release of access for persons.

The manufacturer will not assume any liability for damage caused by pressure effects or avalanches arising from blasting or after blasting with the Wyssen avalanche tower has taken place. If for unknown reasons, blasting with the installation described above either cannot take place or only inadequately (e.g. if the installation does not function), alternative securing methods must be used or the area cordoned off for persons.

It is the responsibility of the locally responsible avalanche expert to decide whether and at what point in time blasting will be carried out. It is also his responsibility to decide after blasting has taken place, whether and when an area endangered by avalanches can be reopened for persons.

There is a residual risk of a misfire with the avalanche tower, too. In compliance with the statutory provisions, these must be recovered and defused. The manufacturer will not assume any liability for injury to persons or material damage as a result of misfires.

It is strictly forbidden to dismantle, bridge or bypass safety and monitoring equipment.

In the case of emergency situations (such e.g. unintentional triggering of the primer during assembly of the charges etc.), the person responsible for blasting draws up a safety concept and instructs the operating staff accordingly.

## 2.4 Licensing and training of personnel

Personnel operating the Wyssen avalanche tower must be officially appointed by the company management and trained by the supplier of the installation with the appropriate personal certification.

Persons who have not been trained by the supplier and who do not have the appropriate certification may not operate the installation, even if they have been instructed within the company by work colleagues. Refresher courses are to be commissioned as required by the operator with the supplier.

In addition, personnel must be authorised and possess a permit for handling explosives for artificial release of avalanches.

### Switzerland:

Are in possession of a valid permit for the artificial release of avalanches issued by the SBFI (State Secretariat for Education, Research and Innovation).

### Austria:

Expertise certificate for general blasting operations ("person authorised for blasting") compliant with the expertise ordinance

### Norway:

Are in possession of a valid permit for technical blasting issued by the Norwegian Directorate for Civil Protection (DSB).

Service and maintenance work may only be carried out on the installation that are described in this instruction manual. Any further work must be carried out by the supplier's qualified personnel. If any malfunctions occur of the installation, the supplier must be informed at all costs, independent of whether these can be rectified in-house or by qualified personnel. It is prohibited to independently carry out mechanical modifications and alterations on the installation or to reprogram the operating software.

Depending on the explosive used, wearing of special protective clothing may be prescribed, e.g. safety gloves or respiratory protection for the preparation of explosive charges. Here the safety regulations of the explosives supplier must be observed.

For operating and handling of the installation, the acknowledged rules for occupational safety are to be observed. (CH: SUVA, AT: Work Inspectorate, NO: The Norwegian Labour Inspection Authority)

## 2.5 Initial commissioning

Initial commissioning of the installation may only be executed by personnel from the installation's supplier. The official handover of the installation is made and confirmed following commissioning by the operator and supplier according to the acceptance and inspection report.

Recommissioning after the seasonal break in operations can be carried out independently by personnel trained and qualified by the supplier in accordance with this manual.

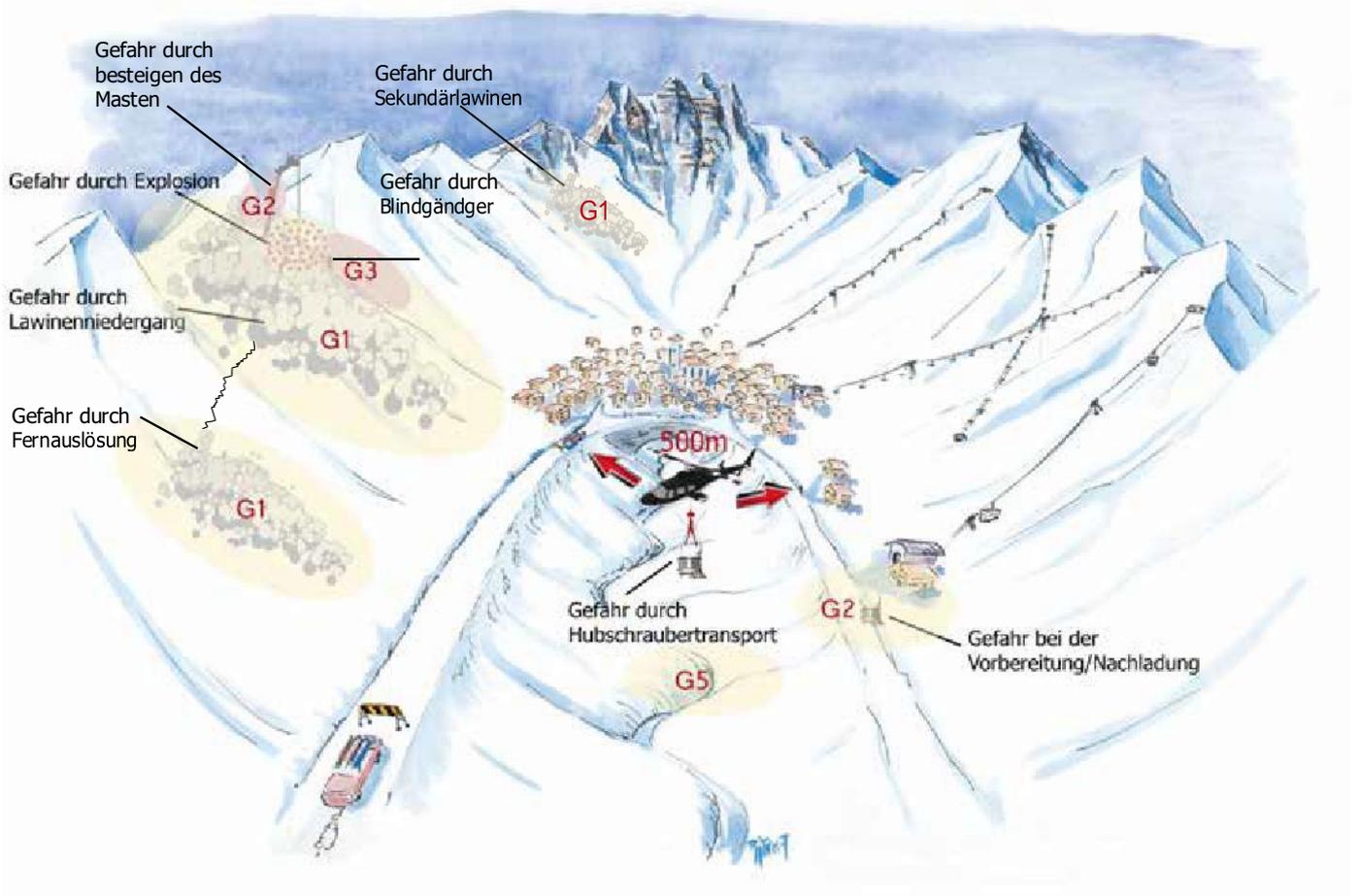
## 2.6 Maintenance

The operator of the installation is obliged to have the supplier carry out maintenance for each individual installation utilised. This includes an annual inspection with maintenance and servicing of the installation by the supplier.

See chapter 9.1.4

## 2.7 Work-specific dangers

The various sources of danger that can arise in the different regions around the installation are explained below.



### 2.7.1 Danger area 1 (G1)

#### Area when an avalanche is released.

The following dangers exist when an avalanche is released with the avalanche tower.

- ( Danger through the explosion (pressure wave) in a range of up to 500m  
Prior to any blasting it has to be ensured by checkpoints that nobody is in the danger area of the explosion.
- ( Danger due to avalanche  
Prior to any blasting it has to be ensured by checkpoints that nobody is in the region of the avalanche path
- ( Danger from an unexpectedly long run-out distance of the avalanche  
On the basis of the snow conditions (risk after heavy snow falls), it must be assessed whether a controlled release can be carried out at all.
- ( Danger through remote-controlled release  
The danger of triggering a secondary avalanche must be assessed on the basis of the snow cover stability, topography, propagation of seismic waves or air pressure respectively.

#### Fazit

- ( To prevent personal injury, evacuation, closure and safeguarding of the whole danger area by checkpoints are prerequisites for a controlled remote-controlled release of avalanches.

## 2.7.2 Danger area 2 (G2)

### Area during preparation and reloading of explosive charges.

In this area there exists a danger of unintentional triggering off an explosion during handling (reloading or maintenance work). For this reason only trained personnel may carry out this work. Access to the following areas during this time is prohibited for unauthorised persons.

- ( Explosives magazine including the transport route to the location of assembly of the charges
- ( Area around the work place during assembly of explosive charges
- ( Area of the short-term intermediate storage of the explosives after assembly of the charge
- ( Area along the transport route from the assembly work place to the magazine-box
- ( Area around the magazine-box during placing and removing charges

## 2.7.3 Danger area 3 (G3)

### Area around a misfire.

If a charge dropped by the avalanche tower does not detonate, this is a misfire. This poses particular dangers, to which attention must be paid, see chapter 11.0 Misfires.

It is possible that the percussion fuse of the explosive charge has not been pulled, which means that the charge is still live. Misfires can potentially slide away from the tower and be carried off by an avalanche. In this way they can reach areas that are frequented by people.

If the retaining cord of a misfire is found by an uninvolved person and then pulled, this can detonate the charge, leading to serious consequences.

For reasons mentioned, it is important that misfires are located and defused as quickly as possible in compliance with the Explosives Act.

## 2.7.4 Danger area 4 (G4)

### Area when ascending a tower.

The tower must be climbed in order to carry out maintenance on it or to repair any faults. Here there is the danger of life-threatening injuries through falling.

As soon as the tower is being climbed, personnel must protect themselves from falling with a safety harness and a safety retaining rope.

## 2.7.5 2.7.5 Danger area 5 (G5)

### Area during helicopter transport.

Along the helicopter transport route during transportation of the magazine-box between the loading/unloading location and the tower, there exists the danger that the loaded magazine-box could fall due to intentional or unintentional jettisoning or due to breakage of a load-bearing component.

Since when jettisoning or in the case of an unintentional loss of the loaded magazine-box from a great height, persons could be injured or material damage could occur, transport flights are prohibited over inhabited areas, heavily used roads, sport facilities and ski slopes where persons are present etc.

A distance of at least 500m must be kept from uninvolved persons or public buildings. The loading places and the flight route must be approved by the responsible aviation authority. (CH: BAZL; AT: Austro Control; CA: XXXXXXXXXXXXX)

## 2.8 Safety functions

The safety of the machine is dependent on the electronic control system of the magazine-box. The electronic control system of the magazine-box contains a part in which safety functions in conformity with ISO 13849 -1 2006 have been realised.

In summary, the functional safety ensures that under no circumstances can the machine start without the operator's intention. However, this rather trivial and logical basic function must function if any component fails.

Failure of all safety functions could lead to avalanches being unintentionally released and fatally injuring persons. Thus all safety functions fulfil the following requirement level:

### ISO 13849-1:2006 Category 3 PL d

All safety functions are realised by the electronic control system. The docking system spike switch B1 is additionally used for the safety function SIF3.

There is only one mode of operation. The override button does not bypass the safety functions, but is simply another way in which the supply of the motors can be activated.

### Troubleshooting and maintenance

Troubleshooting and maintenance work may only be carried out by the manufacturer.

In case of a failure of the safety functions, an undesired start-up of the machine cannot be excluded. In this situation, the risk exists of an undesired release of avalanches by explosives. Category 3 includes single-error safety, so that a single random error cannot lead to endangerment.

Errors in the safety functions are automatically displayed at the control point. See also error 32 on the error list (chap. 16.1)

The safety functions cannot be bypassed (no muting).

The safety functions are implemented in the electronic control system and designed for the following environmental conditions:

Powersupply: 12V (battery)

Temperature: -45°C to +70°C

For simple troubleshooting, the four LEDs on the control board are used:

<b>H11</b>	Off	Switched off (or LED defective)
	Flashing	Safety channel 1 running, docking system spike not detected
	Double Flashing	Safety channel 1 running, docking system spike detected
	Lights continually	Error in safety channel
<b>H12</b>	Off	Safety channel 1 is in safe status (disconnects the supply of the motors)
	Flashing	Safety channel 1 is in active status (supply of the motors released)
<b>H21</b>	Off	Switched off (or LED defective)
	Flashing	Safety channel 1 running, docking system spike not detected
	Double Flashing	Safety channel 1 running, docking system spike detected
	Lights continually	Error in safety channel
<b>H22</b>	Off	Safety channel 1 is in safe status (disconnects the supply of the motors)
	Flashing (dt. Leuchtet)	Safety channel 1 is in active status (supply of the motors released)

## **2.8.1 SIF1 Prevention of remote-controlled start-up without a valid blasting code**

In order that the drive motors in the magazine-box can be released, a valid blasting code must be entered and accurately transmitted to the magazine-box.

Once the drive motors have been released, these will be securely cut off again from the supply after a maximum of 15 minutes. However, they can be cut off at an earlier time by the control system (e.g. after successful blasting).

## **2.8.2 SIF2 Prevention of an undesired start-up if the override button has not been intentionally actuated**

In order that a test run can be started without radio connection (e.g. when loading in the bunker), an override button (S2 test button) is provided, which releases the drive motors for a maximum of 15 minutes when actuated.

In order that an unintentional actuation of the button does not release the motors, it has to be pressed for 5 seconds (more precisely 4 to 6 seconds). A shorter (<4s) or longer (>6s) actuation does not release the motors.

## **2.8.3 SIF3 Prevention of remote-controlled start-up during the flight**

During the transportation with a helicopter, the danger exists of an explosive charge being dropped via the control point. Detonation of an explosive charge under the helicopter could endanger both the helicopter and the pilot.

In order to reduce this risk, a switch monitors whether the magazine-box has been placed on a tower. Entry of blasting code is only enabled once the magazine-box has been placed on a tower.

Triggering of an explosive charge during the flight is thus effectively prevented.

## 3 Construction of the Installation

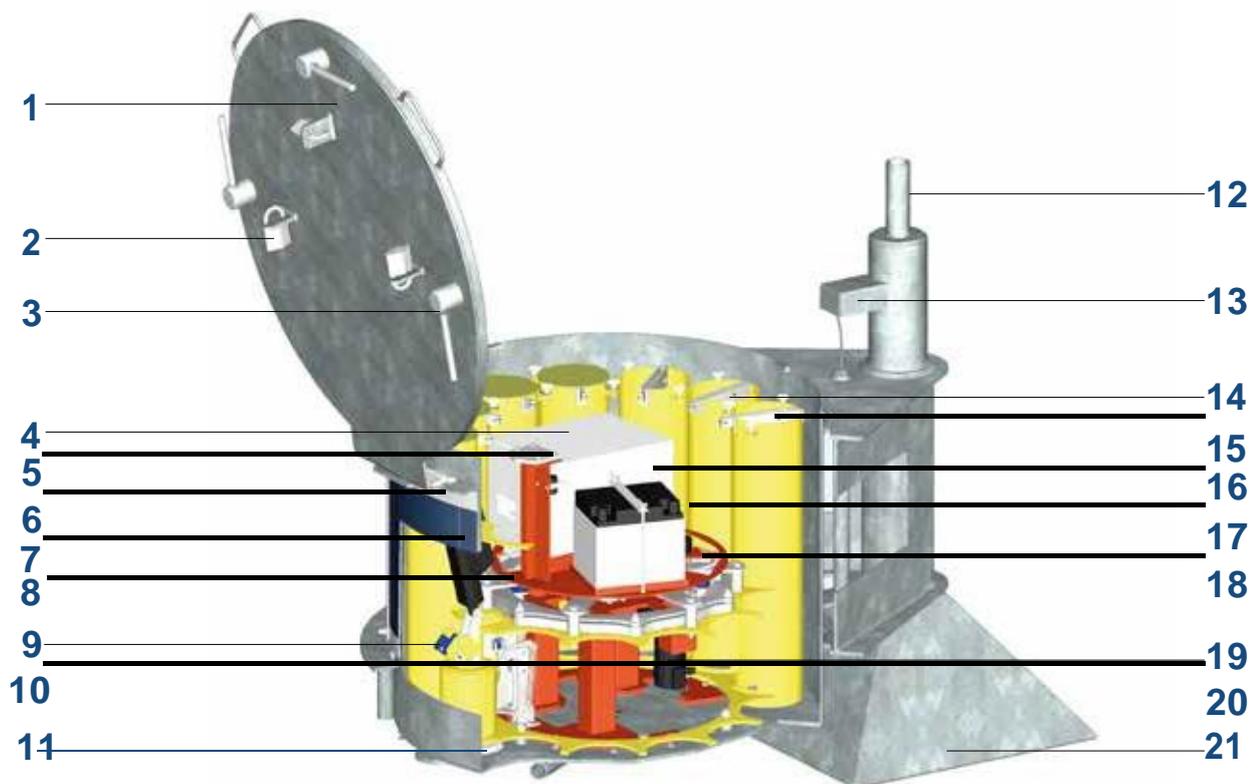
### 3.1 Assemblies

The installation essentially consists of the following assemblies:

- ( Magazine-box
- ( Tower
- ( Command centre
- ( Explosive charge
- ( Wyssen helicopter latch

### 3.2 Magazine-box

In the magazine-box there are the prepared explosive charges, the entire mechanism and control system as well as the radio transmission elements.



- |    |  |    |   |
|----|--|----|---|
| 1  | Magazine-box cover                             | 12 | Antenna holder (antenna not shown)  |
| 2  | Padlock 3 items                                | 13 | Monitoring sensor for the correct position of the magazine-box on the tower |
| 3  | Turn lock                                      | 14 | Cable dropper   |
| 4  | Control system with operating buttons on top   | 15 | Tube holder   |
| 5  | Seismometer                                    | 16 | Battery 12V   |
| 6  | Solar panels                                   | 17 | APOS: Goniometer potentiometer, analogue                                    |
| 7  | Lock cylinder                                  | 18 | RPOS: Carousel rest position end switch                                     |
| 8  | DPOS: Carousel position switch, cam-controlled | 19 | Gear motor  |
| 9  | Lock cylinder position switch                  | 20 | LPOS1. Charge drop detection switch   |
| 10 | LPOS2. Charge detection switch                 | 21 | Insertion funnel  |
| 11 | Dropping hole                                  |    |   |



## 3.3 Tower

The tower is used to accommodate the magazine-box in the terrain.

It is preferably situated in the upper area of the avalanche fracture zone of an avalanche slope.

Depending on the substrate, the tower is preferably anchored with a drilled anchor into rock or with micro-piles. All that is required for this is a small foundation (1m\*1m) to fix the tower.

The tower itself is practically maintenance-free. Only the docking system spike requires maintenance prior to the start of each season, see chapter 8.2.3.

The ladder equipment consists of a ladder with permanently mounted rungs, a locking door with a padlock, a platform and safety equipment to prevent falls. When climbing the tower, a safety harness compliant with European standards must be worn.

### Safety regulations when climbing the tower

Towers may never be ascended without supervision from a second person. This means that there must always be someone in the immediate vicinity when a tower is being ascended. This is so that in an emergency, first aid can be provided or a rescue requested.

The ladders may only be delivered by the supplier of the tower. Liability will be categorically rejected for ladders that have been installed by third parties or by the user himself.

There is an information sign on the pedestal of the tower that explain to unauthorised and non-involved persons the function of and dangers posed by the avalanche tower LS12-5.



### Personal protection equipment

To protect against falls, a safety harness compliant with the European standard EN 361 must be worn in conjunction with a fall arrester and two Y-shaped supporting ropes with energy absorber. Each of the supporting ropes must be fitted with a large safety carabiner.

We recommend the Tractel brand HT42 safety harness and the Tractel brand LDAD 11-10-53-53 supporting ropes (connections) available from Wyssen Avalanche Control AG.

The only fall arrester that may be used is the Fallbloc brand, supplied by the IMMOOS GmbH company in 6414 Oberarth Switzerland. The operating instructions are included with the delivery and must be observed at all costs when handling this fall arrester.

### Safety equipment on the tower

Along the ladder there must be installed a steel cable with a diameter of 8mm, to which the guided type fall arrester (see description above) can be attached.

Above the ladder on the small platform there is a support post with two steel rings fixed at the top. Before the protection is removed from the Fallbloc fall arrester and the ladder is left, the safety carabiner must be clipped into one of these rings.

If the tower is to be climbed to load the magazine-box with explosive charges, it has to be equipped with platforms at the side. There are further attachment points on the magazine-box into which the safety carabiner for entering the platform can be clipped. At least one protection carabiner must be attached during the entire duration away from the ground.



### Protection against ascent by unauthorised persons

In order to deny the ascent by unauthorised persons, either the ladder is equipped with a locked door or the lower end of the ladder terminates 4m above the ground.

The closing door must be secured with a padlock against opening by unauthorised persons.

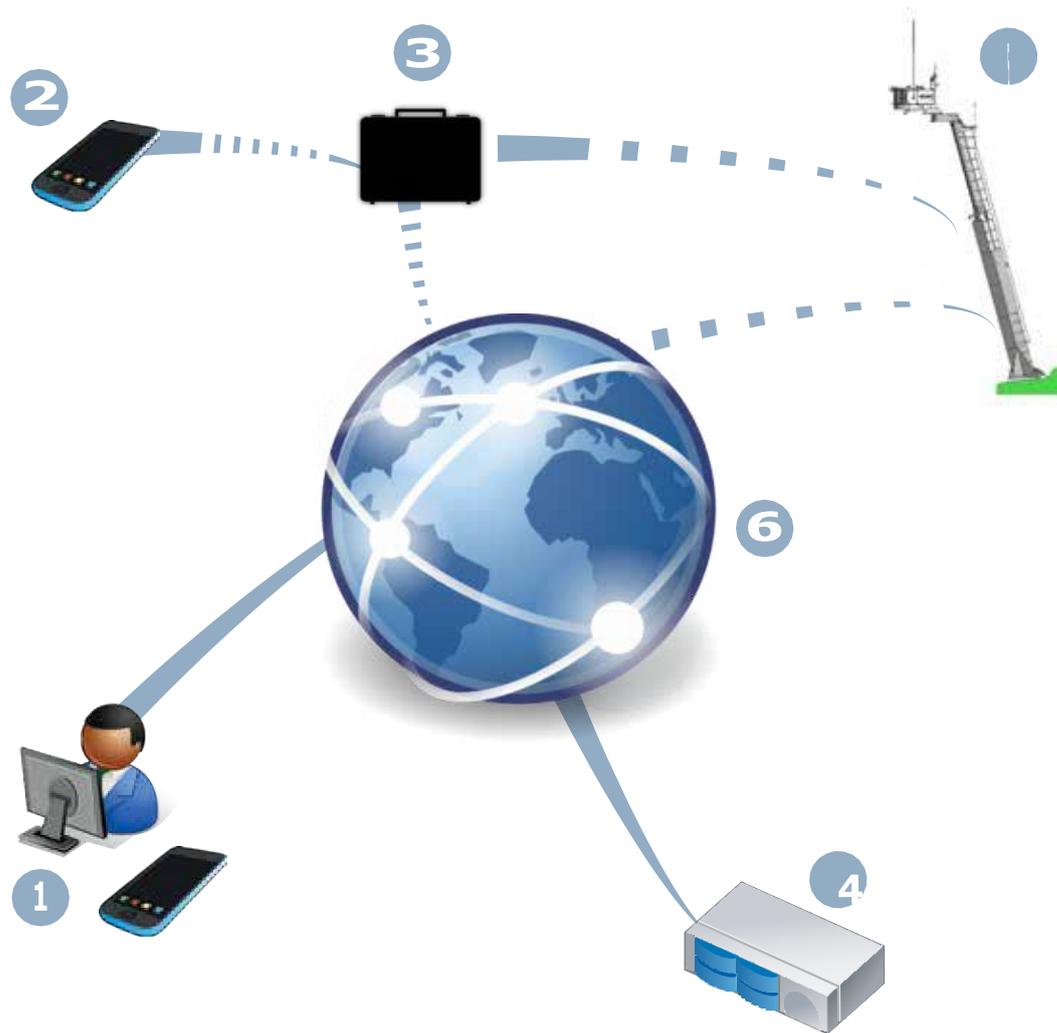
## 3.4 Communication

Communication functions over the following elements.

- ( Web-enabled device with Internet connection
- ( Relays for direct connection to the avalanche towers
- ( Wyssen Avalanche Control Centre

The operation of the installation can be made from different locations with an Internet-enabled device, or by radio using a relay.

Due to the fact that the installations are permanently connected with the Internet, the supplier has external access to the installation and can thus assist the customer at any time in case of problems or faults.



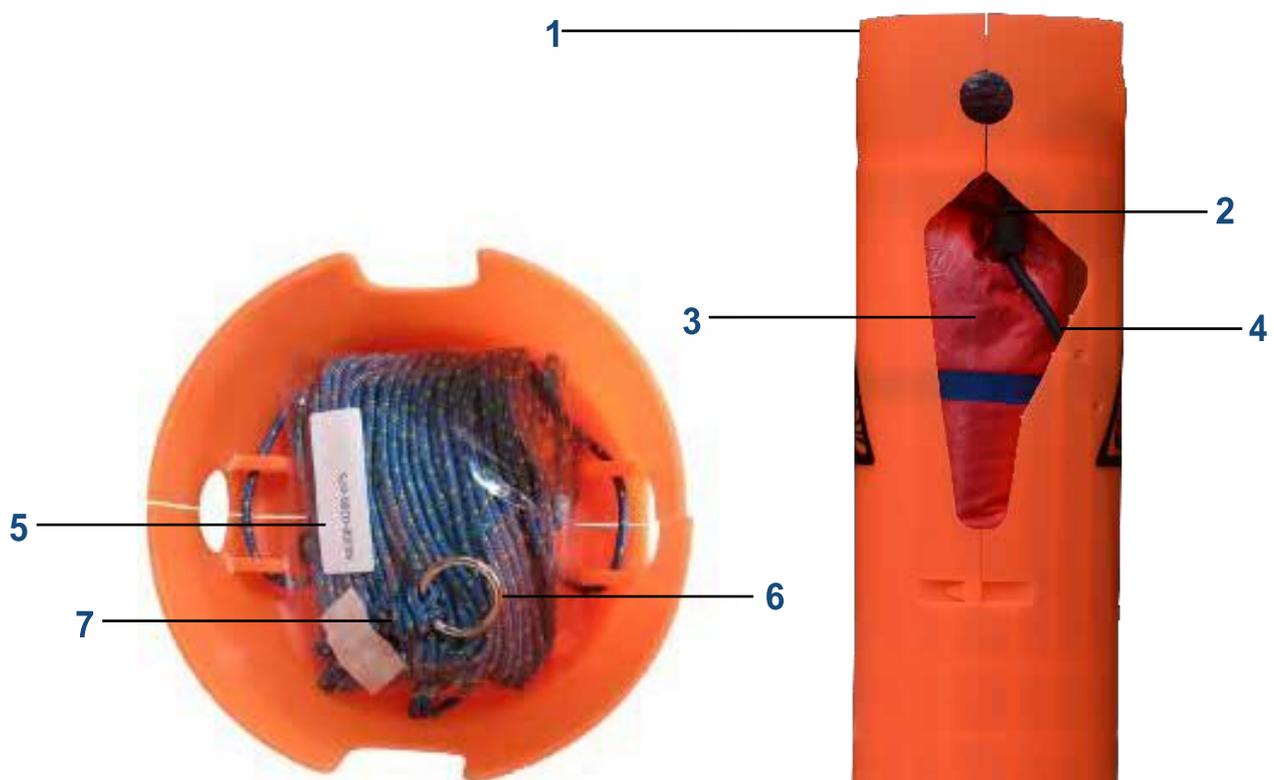
- 1, 2 Device with web browser (PC, Notebook, Tablet, Smartphone)
- 3 WAC.3 Base for radio connection with avalanche tower (optional)
- 4 Server of Wyssen Avalanche Control AG
- 5 Avalanche tower LS12-5
- 6 World Wide Web

### 3.5 L07 explosive charge

The explosive charge consists of the elements shown below. The charge containers are packed with 4.5 kg of explosive. Only the explosives and cartridge sizes listed in chapter 4.3 may be used.

The charges are assembled by the operator on-site. The package contents from Wyssen Avalanche Control AG only contain the charge containers with integrated percussion fuses 83 and the non-commercial accessories.

Blasting materials (explosives, detonators and safety fuses) are directly obtained from the appropriate supplier by the operator.



- 1 Charging tube (2 half-shells- no. 411.950)
- 2 Percussion fuse (2 pcs. - no. 5060SZ83)
- 3 Explosive (1 cartridge - according to chap. 4.3)
- 4 Safety fuses (2 pcs. à 30cm - according to national regulations)
- 5 Cord sack (1 pc. - no. 411.920)
- 6 - Retaining ring (1 pc.)
- - Wire hooks (2 pcs. not visible)
- 7 - Polyamide braided cord  $\varnothing$  3 mm (approx. 7.5 m)

## 3.6 Wyssen Helicopter Latch HK-02

### 3.6.1 Intended Use

The helicopter latch is used for the return transport of the Wyssen avalanche tower magazine-box from the tower to the depot. With the aid of this latch, the helicopter pilot can lift the magazine-box from the tower on his own without any additional personnel assistance. Under no circumstances may the latch be used for lifting other loads.

Transportation of the magazine-box to the tower is undertaken without this latch and is also possible without any additional aid. An electrical latch must be used. Then only with this can the pilot unclip the magazine-box from the docking system spike on his own.



**Danger**

The orange-coloured Wyssen helicopter latches made from round steel may no longer be used.



**Danger**

During lifting of the magazine-box, the presence of persons on and around the tower is strictly forbidden.



### 3.6.2 Safety regulations when handling the Wyssen helicopter latch

Working with the Wyssen helicopter latch without training and instruction by the supplier and the responsible helicopter company is prohibited.

Attaching the Wyssen helicopter latch to the electrical latch fixed to the helicopter is only permitted by personnel from the helicopter company, or by personnel that have been appropriately instructed.

During the work with the helicopter, it is prohibited for persons to be in the landing zone danger area, who are not directly participating in the flight manoeuvre.

To unload, the latch may only be opened by means of the black lever on the outside of the latch. Otherwise, there is the threat of injuries due to the prevailing and undefinable forces.

See chapter 7.0 "Transporting the magazine-box by helicopter" for further safety regulations and the basic procedure when transporting with a helicopter.

**Caution**

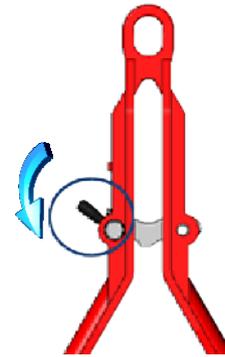
The helicopter latch may only be carried by at least two people on account of its heavy weight. Carrying heavy loads can lead to permanent damage to health.

### 3.6.3 Uncoupling the magazine-box

Uncoupling the magazine-box may only be initiated if the magazine-box is resting on the ground and the holding line to the helicopter is no longer under tension.

The latch may only be opened by actuating the black lever. Otherwise injuries can occur to the fingers, hands or arms through the prevailing forces.

After opening the pilot can be signalled that he can raise the helicopter again.



### 3.6.4 Maintenance

Prior to flying a magazine-box with the Wyssen helicopter latch, the latter is to be visibly checked each time for its operational reliability. Thereby the following points must be observed according to chapter 7.1.17 "Inspection of the Wyssen helicopter latch".

If any of these points are not in order, work with the Wyssen helicopter latch must be stopped. The supplier is to be contacted immediately to discuss further procedure.

In the course of annual servicing of the installation by the supplier, the latch is inspected and serviced. After 100 flight rotations, the latch is subject to a major inspection (magnetic crack testing, new painting) by the supplier. The maximum operating life of a latch is 10 years or 500 transports.

# 4 Charge construction

Prior to commissioning and operation of the Wyssen avalanche tower, it is imperative to read and strictly comply with the chapter 2.0 "General Safety Regulations". Furthermore, for handling explosive materials, the legislation of explosives and the regulations of the explosives supplier must be read and complied with.

## 4.1 Requirements for the personnel carrying out the operations

According to the description in chapter 2.4 "Licensing and Training of Personnel", the installation may only be operated by qualified personnel authorised for avalanche blasting with additional personal training certification by the supplier of the Wyssen avalanche tower.

It is forbidden to operate the avalanche tower when under the influence of alcohol, drugs, medication or under severe psychological stress or other safety-threatening personal situations.

## 4.2 The work place when assembling the charges

In order to enable safe working environment when assembling the charges, certain requirements for the work place are indispensable according to the list below:

- ( The statutory provisions for the work place and its surroundings, as well as the safety regulations described in chapter 2.7.2, are to be strictly complied with.
- ( The magazine-boxes provided for assembly may not stand far away from the work place where the charges are prepared. The charges should only have to be carried a short distance of maximum 50m. The route from the work place to the magazine-box must be free from unauthorised persons and obstacles.
- ( Explosives may never be left unattended.
- ( For the assembly of the charges, a large solid table should be provided where work can be performed safely. Only necessary objects and tools may be on the table.
- ( No unnecessary objects may lie on the ground in the area around the table. These constitute a risk of stumbling, which can lead to uncontrolled effects.
- ( The climate at the work place must be warm and pleasant, so that work can be performed without gloves and in comfortable clothing.

## 4.3 Approved explosive products

It must be ensured that the explosives used, the detonators, the safety primer cord and the percussion fuse 83 are approved in the country of application for the artificial release of avalanches and are impact resistant to a temperature down to -30°C. The properties of the explosives and primers must comply with the local statutory provisions. Explosives, detonators, safety primer cord and percussion fuse 83 must be compatible and matched to each other.

Designation	Supplier	Charge Size	Country of application
Riomon T1	SSE CH-3900 Brig	4.5 Kg. ø115 * 480 mm	Switzerland
	Maxam Norge AS NO-2120 Sagstua	4.5 Kg. ø115 * 480 mm	Norway
	Mc Pyro AT-6842 Koblach	4.5 Kg. ø115 * 480 mm	Austria
	???? ?????	4.5 Kg ø115 * 480 mm	Canada

Details siehe technisches Datenblatt Riomon T1 im Anhang -> MISSING!

## 4.4 Individual charge components

The charge consists of the following individual components:

pcs	Designation	Remarks	Supplier
1	<b>Explosive according to separate table</b>	<b>Avalanche explosive</b>	<b>Supplier according to separate table chap. 4.3</b>
2	<b>Safety primer cord, according to valid national regulations</b>	<b>Length of the safety primer cord 25 up to 35 cm</b>	<b>Sprengstofflieferant</b>
2	Obtain safety primer cord in double length with waterproof encapsulated detonators on both sides.	Explosives supplier	Sprengstofflieferant
1	<b>Detonator no. 8</b>	<b>Obtain detonator no. 8 from supplier already encapsulated on the safety primer cord.</b>	<b>Explosives supplier</b>
2	Charge container complete	The complete charge container with two half-shells, two percussion fuses and a cord sack Art.-no.: 411.950	Wyssen Avalanche Control AG
1	<b>Charge container half-shells</b>	<b>Half-shell with two pre-assembled percussion fuses SZ83</b>	
1	Cord sack	Incl. ring, retaining cord and wire hooks	
2	Art.-no.: 411.920 (1 pc.)	Wyssen Avalanche Control AG	
2	Retaining line	Accessory cord 0.3 mm, L = approx. 7 m	
1	<b>Wire hooks</b>	<b>Art.-no.: 411.913E</b>	
1	<b>Retaining ring</b>	<b>Art.-no.: 546902.8/18</b>	
	<b>Vulcanising tape</b>	<b>Do not use normal adhesive tape.</b>	
	<b>Art.-no.: 5267-10VULK</b>	<b>Wyssen Avalanche Control AG</b>	
	<b>RECCO-Sticker</b>	<b>Only prescribed in Austria</b>	<b>In corresponding trade</b>



**Tip**

The article charge container complete (Art.-no.: 411.950-12) includes all individual components that are required for the construction of 12 explosive charges.

## 4.5 Accessories and tools

The required accessories and tools can be found in the following list:

Accessories	Remarks	Supplier
Foam stoppers	Are only included in the first delivery of the avalanche tower. Art.-no.:411.915	Wyssen Avalanche Control AG

Tools	Remarks	Supplier
Pricking awl	Non sparking	Explosives supplier
Knife	Non sparking	Specialist trade
Rule	Non sparking	Specialist trade
Crimping pliers for detonator no. 8	Non sparking	Explosives supplier

## 4.6 Assembling the charge



**Caution**

When assembling the charge, the following sequence must be strictly observed.



**Tip**

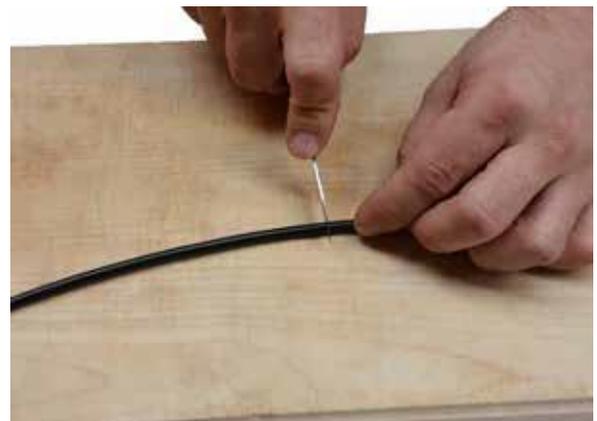
It is recommended to order pre-pressed safety primer cord. Thus the work of pressing the detonators no. 8 is no longer necessary.

### 4.6.1 Preparation of the safety primer cord

- ( Seal both connections between the encapsulated detonators and safety primer cord with vulcanising tape, 2 pcs per charge.
- ( Remove protecting tape from the vulcanising tape, and wind vulcanising tape very firmly.



- ( Cut the double length safety primer cord straight in the middle with a sharp knife on a soft, non-sparking underlay (e.g. a wooden board)



- ( The prepared detonator must look like the example shown on the right. Well pressed and enclosed compactly by the vulcanising tape. (Not like the examples shown below)



**Caution**

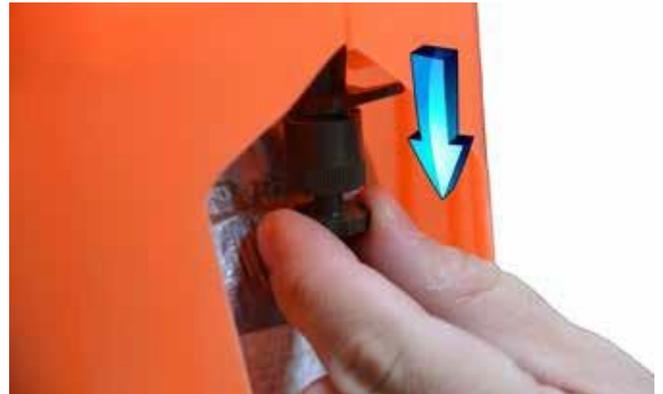
Detonators no. 8 are sensitive to impact and heat and can lead to severe injuries on detonation. See safety details for corresponding suppliers.

## 4.6.2 Preparation of the charge container

- ( Insert the explosives cartridge into one of the half-shell: Make sure that the cartridge lies at the bottom, so that later it cannot slide down any lower in the charge container.
- ( For Austria: attach a Recco sticker to the blasting cartridge.
- ( Put a second half-shell together with the first one.
- ( Place the charge container on the table



- ( Loosen the screw sleeves at the bottom of the percussion fuse 83 by approx. 1 turn and remove the plug. Do not unscrew completely! Hold the percussion fuse 83 at the top with one hand to prevent twisting.



### Warning

If the percussion fuse should be completely unscrewed, do not screw it together again. The charge may not be dropped with this housing. It could result in unexploded material (duds).

- ( (1) Push the free end of the two safety primer cords up to the stop into the assembled percussion fuse 83 and firmly tighten the screw sleeve.
- ( (2) Hold the percussion fuse 83 by the lug with one hand to prevent twisting.



- ( The safety primer cord must be completely inserted into the percussion fuse 83. Allow the detonators to protrude. In a later step these will be put into the explosive.



### 4.6.3 Preparation of the retaining cord

- ( Cut the cord to the correct length. At least 1 m and max. 8m (in order to achieve the largest effective radius, the dropped charge should theoretically hang 3.5 m over the snow cover, so that the ideal cord length varies according to the terrain around the tower location).
- ( Diagonally guide the retaining cord through a hole per half-shell on the charge container and tie securely with a figure of eight loop

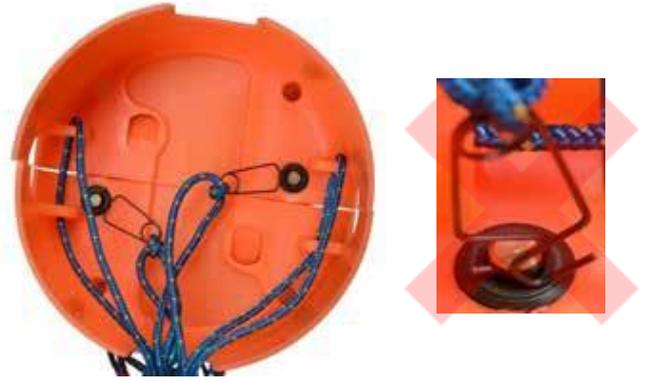


- ( Release the cord attached to the back of the pre-assembled cord sack (8m), and then fasten the sack with the resulting loop to the retaining cord.



## 4.6.4 Conclude charge construction

- ( Clip the spring hooks into the eyelets of the percussion fuse 83 and insert the cord sack with the end (ring) on top.
- ( Place the foam stopper on the top of the cord sack to protect and secure the inserted retaining cord and percussion fuse 83.



- ( Pierce explosives cartridge with the pricking awl through the side holes in the charge container and insert the detonator no. 8 into the explosive.
- ( Clip the safety primer cord in the flaps until a click is heard, in order that tension is relieved.



### Caution

- ( Make sure that the detonators are embedded all round in the explosive and that they cannot come into contact with the charge container.
- ( The safety primer cord should not be stretched after insertion of the detonators, so that it is not pulled out of the percussion fuse 83 due to any deformation of the blasting cartridge.
- ( The retaining cord may not hang down to the ground during charge construction, but must lie neatly beside the charge on the table (avoid danger of unwanted ignition by getting caught by a passer-by)



### Danger

Explosion hazard: As soon as the detonators are in the explosive, the charge is live. A pulling action on the eyelet of the percussion fuse 83 leads to an initialisation of the charge.

# 5 Loading and unloading the magazine with explosive charges

## 5.1 Safety regulations when loading and unloading

The magazine-box must stand on a flat surface for this work. Particular care must be taken to ensure that there is not more than 30 cm free height under the dropping hole in the parked position of the magazine-box.

It must be ensured that there are no objects in the insertion funnel that could lead to an activation of the monitoring sensor.

The work place for assembling charges, the transport route to the magazine-box and the area around the magazine-box must be cordoned off to prevent access from unauthorised persons.

Assembly of the magazine-box must take place in the open, so that it does not have to be transported more than approx. 50 m (only with a pallet truck) and can be directly attached to the helicopter.

## 5.2 Preparation of the magazine-box

- ( Open the padlocks on the magazine-box cover with the keys and turn the locking lever through 90°.
- ( Lift the cover with the handles provided until the safety catch engages.
- ( Due to its heavy weight, the cover of the magazine-box must be opened and closed each time by two persons.
- ( Press all sliders of the cable dropper into the rear position.
- ( Open the screws on the tube holder cover and remove the cover
- ( Remove the cable dropper from the notches (when loading only if tube holders are empty)
- ( Keep the surface on the magazine-box towards the antenna free, so that the prepared charges can be set down.

**Caution**

There is a risk that during opening and closing, the hand can be seriously injured by the falling cover. For this reason, do not hold the hand over the edge of the magazine-box.

In older versions there is no safety catch present. When work is being carried out on the magazine-box, the cover should be secured against unintended falling down.

## 5.3 Loading the explosive charges

Loading of the magazine-box follows according to the following work steps.



### Caution

When loading the magazine-box, the following sequence must be strictly observed.

- ⌋ The charge may never be carried with only one hand. The following method of carrying must be used to transport the charges.



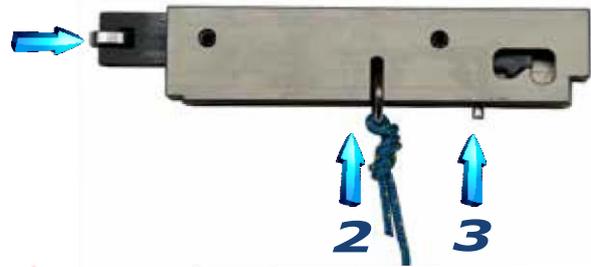
- ⌋ Bring the charge to the magazine-box and set it down on the surface next to the flashing light.
- ⌋ Carefully remove foam stopper from the explosive charge and at the same time pay attention to the cord. (Do not pull)



- ⌋ Take hold of the explosive charges on the inside through the holes at the upper edge of the tube and carefully insert into the tube holder. If the magazine-box is not completely loaded, the charges must be filled from the last tube holder (no. 12). In order that the control system can correctly register the number of charges in a test run.



- (1) The retaining ring is attached to the cable dropper and the slider is brought to the front extended position, so that (2) the ring is held by the cable dropper.
- (3) The slider goes into the front position by pressing the metal pin at the bottom of the cable dropper.



- ( Afterwards the cable dropper is laid in the notches of the tube holder, so that the ball bearings point to the centre of the magazine-box. The cable dropper must be held in mounted position in the notches to prevent shifting, i.e. both recesses must lie inside the tube holder.



**Important**

After the cable dropper has been placed, feel to ensure that the retaining ring is correctly mounted.

After this the cable dropper may no longer be touched, since there is a risk of unhooking the retaining ring. This would result in unexploded material (a dud).

- ( At the end of loading the magazine-box, the cover is placed on the tube holder and firmly tightened with hand screws.
- ( Before the magazine-box is closed again and made ready for transportation, a test run must be carried out according to chapter 5.5.



## 5.4 Unloading explosive charges

In the case that there are charges present in the magazine-box after the winter season has finished, these must be removed according to the following work steps.



### Caution

When unloading the magazine-box, the following sequence must be strictly observed.

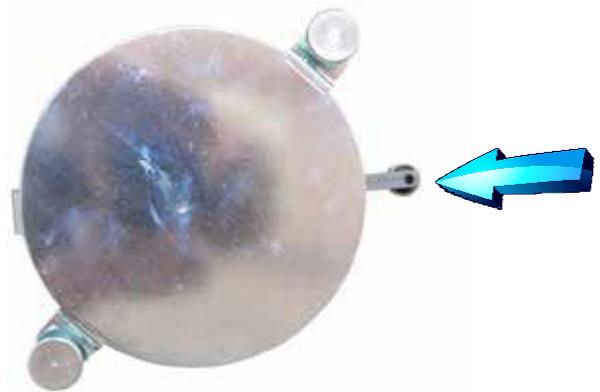
- ⌋ Activate all sliders on the cable dropper by pressing the side of the ball bearings towards the back.
- ⌋ Open the tube holder and remove.



### Danger

Before the cable dropper can be lifted out of the tube holder, it must be checked that the retaining rings are no longer attached. They must first be disengaged according to the description above. Otherwise there is the risk of activating the percussion fuse 83.

A pulling action on the eyelet of the percussion fuse 83 leads to an initialisation of the charge



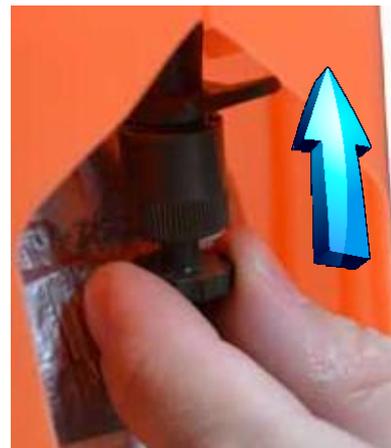
- ⌋ Carefully remove the cable dropper from the tube holder.
- ⌋ Take hold of the charge through the holes at the top and lift carefully out of the tube holder.
- ⌋ Place the charge on a stable table.
- ⌋ Loosen the screw sleeves at the bottom of the percussion fuse 83 by approx. 1 turn.
- ⌋ First pull both safety primer cords out of the percussion fuse through the openings at the side.
- ⌋ Carefully pull out the lower safety primer cord sections with the detonators out of the explosive.



### Caution

It can happen that when pulling out the safety primer cord, the detonator remains stuck in the explosive. Care must be taken at all costs to ensure that both detonators are removed from the explosive.

- ⌋ The safety primer cord sections and the detonators may no longer be used and are to be destroyed in compliance with regulations.
- ⌋ The charging tubes with the explosive and the integrated percussion fuses may be stored in compliance with regulations and kept for future use. However, it is important that the detonators are fitted on the underside again with the plugs, so protecting them from moisture.
- ⌋ In the case of the explosive attention should be paid it is not used beyond the expiry date.



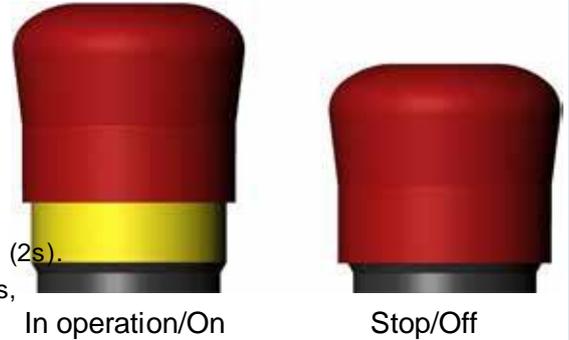
## 5.5 Test run with operating buttons in the magazine

The test run is carried out with the switches on the control system. The display serves to indicate important information about the system.

### 5.5.1 Emergency stop/master switch

After loading the magazine-box with charges (as close as possible to the time of transportation), the procedure must be carried out as follows:

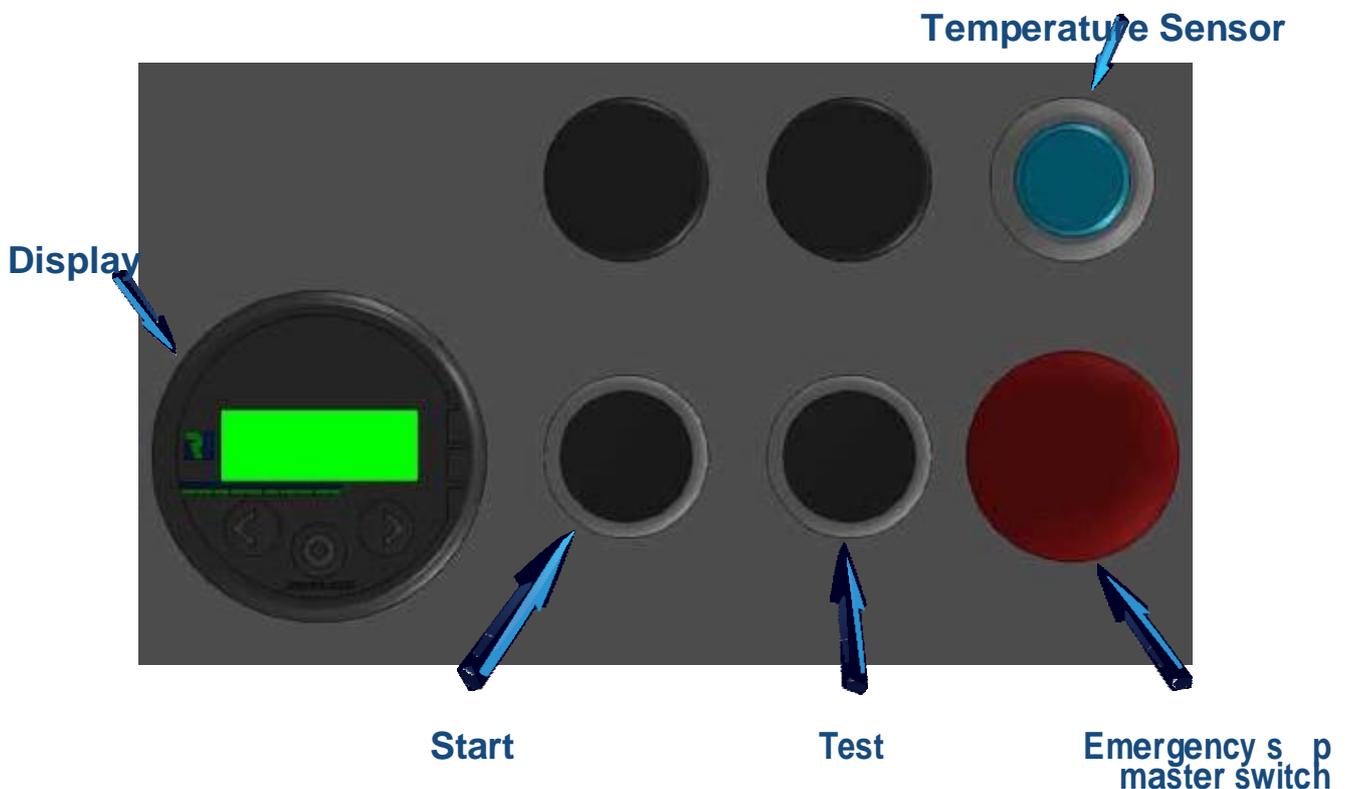
- ( Pull out the emergency stop master switch until the yellow marking is visible.
- ( Press test button until the hourglass on the display switches off again (5s).
- ( The flashing warning triangle signalises test operation.
- ( Press start button until the hourglass on the display turns off again (2s).
- ( The test run now proceeds automatically and lasts about 8 minutes, depending on the charge number.
- ( When the warning triangle switches off, the test run has been successfully concluded.
- ( Do not switch off the control system before transportation or carry out another test run prior to the helicopter transport.



**Danger**

As long as the red Caution signal is flashing, the magazine-box is in test operation, and under no circumstances may it be flown. The magazine-box may only be flown when it is in perfect condition. Likewise the dropping hole lock cylinder must be completely locked.

If now the system is in proper condition, the cover of the magazine-box can be closed again and secured with the padlocks. The installation may not be switched off any more, otherwise the charge number is lost.



### 5.5.2 Disconnection device

The disconnection device is the X20 battery plug. When working on the electrical equipment, the emergency stop must be actuated and the battery disconnected.



# 6 Remote-control with the Wyssen Avalanche Control Centre WAC.3

The Wyssen avalanche towers are controlled using an intuitive web application.

This can be accessed on <https://control.wyssenavalanche.com> or with the QR-Code below.

After calling the website, the login window appears. Each user of the Wyssen Avalanche Control Centre WAC.3 must have a personal login issued by the Wyssen Avalanche Control AG Company, which can be changed at any time by the user.

A login must be issued by the manufacturer of the installation. The same login may not be used by more than one user.

Login with the personal code on <https://control.wyssenavalanche.com>

Login with the personal code on <https://control.wyssenavalanche.com>



**Tip**

If the login data is lost, a new one may be requested at the above address. The transfer of login data internally or externally is not allowed. Login data are used for reasons of traceability and are personal.

During normal usage of the software, informative and clear support is available at all times to assist you. This support can be invoked by clicking on the ?-symbol.

## 6.1 Blasting

The charge drop is controlled by an electronic control system in the Wyssen avalanche tower. The control system of the Wyssen avalanche tower has been developed according to the latest standards, so that malfunctions do not lead to undesired charge drops.

A code list is used in order to maintain the high standard of safety. If you want to start a blast or a test run with the Wyssen Avalanche Centre WAC.3, you will be asked for a code. Using the number of the blasting code, you read off the eight digit blasting code from the code list and enter this into the numeric field.



**Danger**

When the blasting code is entered, the power supply is activated for the drive motors of the dropping mechanism. As soon as you enter the blasting code, the control system can blast during the next 15 minutes maximum.

If the blasting procedure / test run has been concluded, the release is automatically finished. This is displayed on the Wyssen Avalanche Control Centre WAC.3 by the status "Closed and secured". In this case no further charge can be dropped.



**Tip**

If the code list has been used up or is lost, a new one can be requested online under Wyssen Avalanche Control Centre WAC.3.

## 6.2 Service and Support

When the Wyssen Avalanche Control Centre WAC.3 is installed, the system will be completely configured and thoroughly explained to you by our service personnel. If you should be uncertain or if any problems should arise, we are available for you at any time on our 24h service hotline.

# **7 Transport of the magazine-box by helicopter**

## **7.1 Safety regulations**

### **7.1.1 Helicopter company approval**

Transport flights with the avalanche tower magazine-box may only be carried out by helicopter companies that have these operations described and officially approved in the Flight Operation Manual (FOM). In Switzerland or in Austria this can take place through e.g. the responsible civil authorities.

### **7.1.2 Agreements between pilot and ground staff**

Prior to the first flight transport order, the pilot has to discuss the procedure and the particular dangers involved in this work with the specified personnel. The personnel must be instructed particularly in the operation of the load-carrying equipment, the latch and the general dangers when flying external loads.

### **7.1.3 Communication check via radio signal**

During the approach to the receiving point, the pilot must establish contact with the ground staff as a communication check. If this attempt fails, the helicopter must land and the malfunction rectified prior to transportation.

### **7.1.4 Personal protective equipment for the ground staff**

The ground staff must wear the following protective equipment when attaching and detaching the magazine-box under the hovering helicopter: Helmet, safety goggles, gloves, suitable clothing and solid footwear.

### **7.1.5 Conditions at the receiving /unloading point**

The receiving /unloading point of the charged magazine-box must be flat and provide sufficient space for the flight manoeuvre. There must be a take-off and approach corridor available, so that no inhabited area or other areas occupied by people have to be flown over. No objects are permitted in the area around the receiving /unloading point that under certain circumstances could activate the monitoring sensor in the insertion funnel of the magazine-box.

### **7.1.6 No unauthorised persons in the danger area**

During the flight manoeuvre no unauthorised persons or persons not participating in the manoeuvre are allowed to be in the region of the receiving /unloading point. The location is to be cordoned off with a safety distance of 500 m.

### **7.1.7 No manipulating with the Wyssen Avalanche Control Centre during transports of magazines**

No manipulating with the Wyssen Avalanche Control Centre is allowed as long as transports are being made with magazine-boxes. Manipulating is only permitted with the Wyssen Avalanche Control Centre after the helicopter has left the danger area.

### **7.1.8 Perfect condition of the magazine-box**

Prior to each initial and return transport, the responsible blaster has to ensure that the charge-dropping mechanism is on stand-by, the dropping hole is closed and that the whole system is in perfect condition.

### **7.1.9 Weather**

The wind and weather conditions have to be taken into consideration. If the conditions do not allow a safe flight manoeuvre, the transport must be postponed.

### 7.1.10 Air passengers (PAX)???

No passengers are allowed during transportation of the magazine-box.

### 7.1.11 Flight route

Since persons can be injured or material damage can occur in the event of an emergency drop or unintended loss of the magazine-box, the following points must be complied with.

Flying directly over densely populated areas, used roads as well as people, technical installations (e.g. mountain cableways, mountain restaurants and relay stations) and ski runs is prohibited.

The routes taken by which magazines are transported to the Wyssen avalanche blasting system must be so chosen that from the loading/unloading place to the avalanche tower at all times and in all directions a distance of at least 500m is maintained for any persons not immediately necessary for the operation.

Transport flights with the specified system may only be carried out within the country borders.

The flight route must be accepted by the appropriate civil authorities of the respective country.

### 7.1.12 No transport over any systems in operation and ski runs

Magazine-boxes are not allowed to be flown over installations, ski runs or similar during operating hours.

### 7.1.13 Positioning the magazine-boxes

If during the positioning manoeuvre, the magazine-box hits the tower heavily or is positioned jerkily, the internal mechanism may be damaged.

### 7.1.14 Function test

After a fresh positioning of the magazine-box, a test run is always to be carried out in order to verify proper functioning. The test may only be started after the helicopter has left the danger area around the avalanche tower.

### 7.1.15 Do not stand under suspended loads

After attaching or prior to detaching the magazine-box to or from the helicopter, no persons are allowed to be under the suspended load.

### 7.1.16 Attached loads and load-bearing parts on the helicopter

An electrical latch (Holzer latch) is used for transporting the magazine-box. The helicopter company is responsible for the flawless condition of the load-bearing elements and their operational reliability. The elements must be designed to carry loads of at least 700 kg.

### 7.1.17 Testing the Wyssen helicopter latch

The Wyssen helicopter latch must be regularly inspected and tested for proper functioning and damage prior to each transport of the magazine-box as follows:

- ( The latch must be free to move upwards as far as the stop
- ( The latch must drop and close independently through its own weight.
- ( In the closed state, the notch of the latch must lie on that of the supporting bolt.
- ( No cracks shall be visible on the latch or handle
- ( The latch and the handle must not be deformed.

If any defects are found or if there are any uncertainties, the helicopter latch in question may not be used.

## 7.2 Placing the magazine-box on the tower

Before the magazine-box is placed for operation on the tower, the maintenance work and the test run must be carried out in accordance with the instruction manual.

An electric (e.g. a Holzer latch) latch with a hanger length of about 10 - 30 m has to be mounted on the helicopter for the transportation of the magazine-box to the tower, so that after correct positioning, the pilot can uncouple the load unassisted from the cockpit.

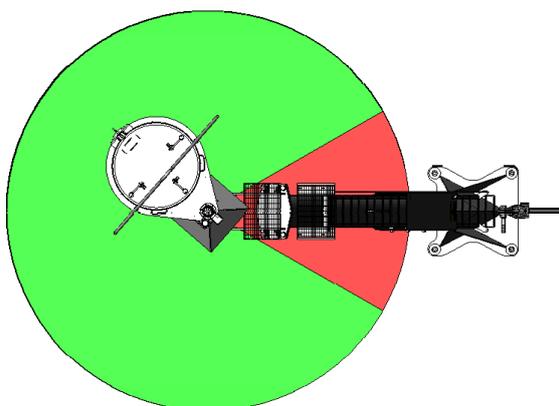
- ( The electric latch is directly mounted onto the transport hanger of the magazine-box.
- ( In order to place the magazine-box onto the tower, the pilot has to bring the insertion funnel exactly over the docking system spike on the tip of the tower.
- ( Then the magazine-box is lowered. It thus turns independently into the correct position, mostly in the direction of the valley.
- ( As soon as the pilot ascertains that the magazine-box is in the correct position, that it has turned and sits firmly on the docking system spike, he can relieve the load by lowering the helicopter further and releasing the latch. A flashing lamp on top of the magazine-box begins to blink for approx. 1 minute as soon as it is correctly positioned.

In case the magazine-box has not been correctly positioned on the tower (flashing lamp does not blink), a test run can be made via the command centre. In accordance with the description in chapter 7.3 "Return transport of the magazine-box from the tower", he must retrieve the magazine-box from the tower with the Wyssen helicopter latch in order to rectify the malfunction.



### Warning

The position of the magazine-box is automatically monitored by GPS. However, an error of the positional monitoring with GPS cannot be excluded. For this reason after placing the magazine-box, a third person (not the pilot) checks that each magazine has been placed on the designated tower.



Green: permitted placement angle



## 7.3 Return transport of the magazine-box from the tower

If all charges have been dropped or if after the season has finished no further blasting takes place, the magazine-box must be transported back from the tower with the helicopter.

As soon as the magazine-box has been lifted for the tower, the monitoring sensor switches off, and the power supply of the installation is disconnected in order to prevent an undesired charge drop.

An automatic (e.g. a Holzer latch) latch with a hanger length of about 10 - 30 m has to be mounted on the helicopter, so that in an emergency, the pilot can uncouple the load unassisted from the cockpit.

Prior to the return transport of the magazine-box, the pilot must find out whether there are any live charges still in the magazine-box.

- ⌋ The Wyssen helicopter latch is attached to the electric latch.

**Warning**

The Wyssen helicopter latch must be inspected and tested for proper functioning and damage prior to each transport of the magazine-box. In case of any deficiencies, the helicopter latch may not be used.

- ⌋ The pilot must then fly over the magazine-box and lower the Wyssen helicopter latch over the fork of the transport hanger. This opens the latch, which then shuts again when lowered further. In this way the magazine-box is attached.
- ⌋ Lift off the magazine-box.  
(Care must be taken to ensure that the tension on the magazine-box is exactly vertical. Otherwise it can tilt on the tower)
- ⌋ Transport the magazine-box to the unloading point and set down carefully.
- ⌋ Uncouple the helicopter latch in accordance with chap. 3.6.3

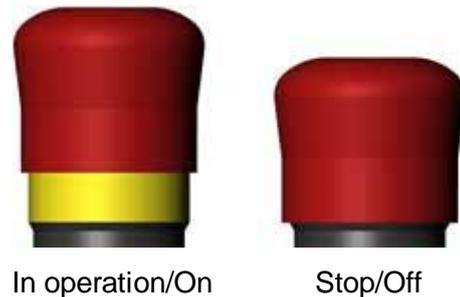


# 8 Seasonal decommissioning/ recommissioning

## 8.1 Decommissioning after end of season

### 8.1.1 Magazine-box

In order to exclude the risk of any damage by lightning, the avalanche tower magazine-box is to be removed as soon as possible after the season has ended. During the summer, it should be housed in protected and dry storage. Explosive charges that have not been used must be removed from the magazine-box, the detonators taken from the explosive and separated from the safety primer cord and then stored according to the Explosives Act. In order to prevent the battery from discharging, it is important to press the emergency stop master switch.



In order that the battery survives the summer without any damage, it should be completely charged with the designated battery charger prior to placing in storage. Connect battery to the charger for at least 24 hours. An appropriate battery charger can be obtained from the Wyssen Avalanche Control AG.



#### Caution

The battery may only be connected in a designated battery charger with a temperature-controlled charging voltage. Battery chargers such as those used for e.g. car batteries are not suitable and damage the battery.

The permitted battery chargers are described in chapter 8.2.

## 8.2 Recommissioning prior to start of each season

### 8.2.1 Command centre

Commission optional command centre according to separate operating instructions.

### 8.2.2 Tower

The docking system spike on the tower is to be cleaned prior to recommissioning. Smooth out any irregularities, burrs and edges with a coarse file and apply a thick layer of waterproof and low temperature resistant (down to -30°) grease of type Fuchs Unitemp, which can be obtained from Wyssen Avalanche Control AG. The fixed ladders and safety equipment on the tower, as also the personal protective equipment, are to be inspected prior to any ascent of the tower for damage and operational reliability.

### 8.2.3 Magazine-box

- ( Charge battery according to chap. 8.3
- ( Measure battery voltage with the white plug removed. It should be 12.8 V before commissioning. Afterwards replace plug
- ( Connect power supply by joining the white plug to the battery cable.
- ( Afterwards a test run should be carried out with the operating buttons according to chapter 5.5 Test run with operating buttons in the magazine control system” to determine that this functions properly. Before the explosive charges are brought into the magazine-box and the latter placed on the tower, an attempt should be made to establish radio connection with the command centre.



#### Warning

Danger to life through falling: As soon as the tower is being climbed, personnel must safeguard themselves against falling with the appropriate personal protective equipment, a fall arrester and a safety retaining rope.

## 8.3 Charging the battery

The battery must be charged with a charger delivered by the manufacturer.

- ( Connect the battery charger to the power supply
- ( Connect the battery to the charger with the white plug
- ( Start the charging process according to corresponding note below



#### Warning

Never charge the battery with a car or quick battery charger, otherwise the battery will be damaged! If an additional battery charger is needed, a suitable appliance can be obtained from the supplier.

## Battery chargers

From 2000 to 2010

### **Voltcraft**

The first battery charger used is simple to handle. The two connecting cables are just plugged into the associated connections to start the charging cycle.

When the green pilot light appears, the battery is completely charged and ready for use.



From 2011 to 2013

### **Voltcraft VC2000**

The Voltcraft VC2000 is slightly more complex in operation than its predecessor model. After connecting the primary voltage 230V, the correct charge setting must be selected with the Mode button.

After the appliance has been plugged in, the green lamp lights up. By pressing the Mode button three times the lamp by the battery symbol with the three bars begins to light up. Now the charger can be connected to the battery for charging.



From 2014 to date

### **Yu-Power YPC4A12**

By connecting the two cables with the battery and the 230V supply, the Yu-Power battery charger starts charging the battery.

When the green pilot lamp lights up, the battery is fully charged and ready for use.



## 9 Maintenance

Maintenance may only be carried out by personnel in accordance with the description in chapter 2.4 "Licensing and Training of Personnel". In order to guarantee that the installation functions properly and safely, maintenance as described in the following must be unconditionally performed on time.

The operator of the installation is obliged to have the supplier carry out maintenance. This includes an annual inspection of the installation and implementation of the necessary maintenance and service work.

**Caution**

Before any maintenance work is carried out on the magazine-box, the main switch in the magazine-box must be switched to OFF.

### 9.1 Maintenance schedule

#### 9.1.1 Maintenance work whenever the magazine-box is reloaded

- ( General visual check
- ( The Wyssen helicopter latch must be inspected and tested for proper functioning and damage prior to each transport of the magazine-box.
- ( It must be checked that all cable droppers function properly and that the sliders can be moved without jamming.
- ( Lubricating the insertion funnel and cylinder tube.
- ( Performing the test run with the operating buttons in the magazine-box according to chapter 5.5 Test run with operating buttons in the magazine control system" with the empty magazine-box in order to detect any malfunctions.
- ( Performing the test run with the operating buttons in the magazine-box according to chapter 5.5 Test run with operating buttons in the magazine control system" after loading and before the magazine-box is again transported to the tower.

#### 9.1.2 Maintenance work prior to seasonal decommissioning

- ( See chapter 8.1 "Decommissioning after end of season"
- ( After the season has ended, the magazine-box must be lifted from the tower as quickly as possible and after disposal of the remaining explosive charges, it should be stored in a protected dry room.
- ( Function Checks and notification to the supplier if malfunctions are known and if special maintenance work is necessary

#### 9.1.3 Maintenance work prior to seasonal commissioning

- ( See chapter 8.2 "Recommissioning prior to start of each season"
- ( Maintenance of the installation by the supplier takes place annually prior to seasonal commissioning.

## 9.1.4 Annual maintenance work by the supplier of the installation prior to seasonal commissioning

In order to be able to guarantee malfunction and maintenance-free operation during the season, each installation must be checked once a year by the supplier's personnel.

During this work, the mechanism and the software are checked for deficiencies and for wear and tear. In case there are any new updates in the software or modifications in the mechanism available, the installations will be updated.

In order to be able to guarantee rapid service, certain work steps must be completed in advance by the owner of the installation.

- ( The magazine, the Wyssen helicopter latch and if available the laptop with the mobile relay must be stored in a dry, easily accessible place.
- ( If a central operating unit PC with a stationary relay is on hand, it must be ensured that this is also readily accessible.
- ( The batteries for all magazine-boxes, relays and the laptop must be fully charged.
- ( If possible, a crane or other lifting device should be on hand to lift the magazine-box, so that the maintenance work can be carried out.

# 10 Malfunctions

The Wyssen avalanche tower is so constructed that it is largely immune to malfunctions. However, since a fault cannot be entirely excluded, the procedure for rectification of malfunctions is described here.

## 10.1 Procedure in case of a malfunction

If a fault occurs during blasting or a test run (e.g. loss of connection, error message from the magazine, etc.), the following measures are to be taken in any case.

- ( Continue to safeguard and maintain danger area G1.
- ( Immediately contact the manufacturer. The manufacturer will be happy to assist you in rectification of the fault with its 24h hotline.

Only the following listed malfunctions may be rectified by the operating staff. Malfunctions that are not listed must in any case be reported to the supplier of the installation and rectified either according to supplier's instructions or directly by the supplier.

### 10.1.1 Interruption of radio connection

If after a successful command is sent to the avalanche tower, the connection is interrupted, this command is normally carried out to its conclusion. I.e. following interruption of radio connection, a test run or charge drop that has once been started, will be executed to the point when the carousel turns back and subsequent closure of the dropping hole. If connection is no longer possible, it must be ensured prior to flying with the magazine-box that this is completely closed.

# 11 Misfires (sollte doch Dudssein)



## Danger

If there is a misfire in the area, procedure for the recovery and destruction of the misfire is to be followed according to the regulations of the respective country.

Under no circumstances may the magazine-box with a suspended **misfire** be transported by helicopter.

If explosive charges misfire, then prior to recovery of the misfire, a waiting period of at least 15 minutes must be observed in every case. After this time limit has expired, misfires are to be cleared as quickly as possible by trained personnel, whilst observing the appropriate safety measures.

By default, misfires get stuck and are not automatically dropped.

In order to drop, the emergency reset button in the operating software must be pressed while observing from a safe distance. This will drop the charge and the magazine-box closes again.



## Danger

If a cord is found in the area of a possible misfire, under no circumstances may this be pulled. The charge may also not be moved before the retaining cord has been previously separated from the percussion fuses. Otherwise this can lead to the activation of the percussion fuses and with a high probability, triggers the explosion of the charge.

## 11.1 Detection of a misfire

Whether or not the detonation of a charge has taken place, can in most cases be determined acoustically. The detonation of a dropped explosive charge is also displayed in the operating software. If this display does not appear, it must be assumed that there is a misfire in the terrain. In case of uncertainties, the supplier can determine with further tests whether a misfire is involved.

## 11.2 Preparing safety precautions

In case of a misfire, the responsible blasting expert has to draw up safety measures that describe the procedure after such an event has occurred. Suitable procedures are to be described that depend on the area. The information provided in the Annex must be observed at all costs.

## 11.3 Types of misfires

Generally, a distinction is made between two possible types of misfire, hanging from the tower or lying in the snow. It can occur in both cases that the detonator has not yet been pulled. This poses increased danger, as a pull on the cord could activate the detonator.

### 11.3.1 Type A1 (misfire hangs on stretched cord)

#### Assessment

The charge was dropped and hangs on stretched cord underneath the magazine-box, and both wire hooks are evident.

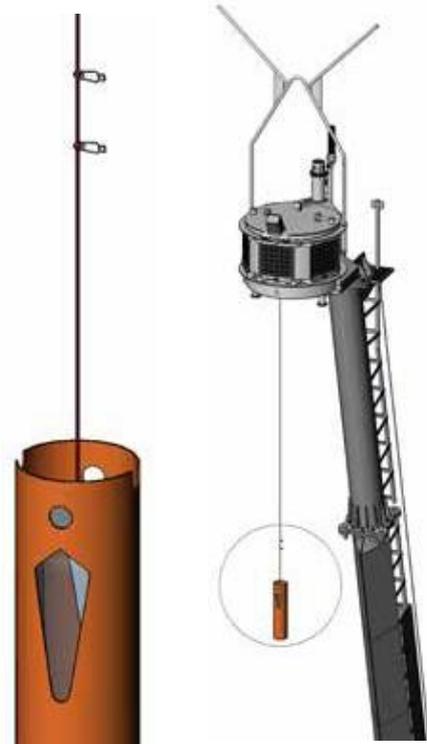
This is a misfire due an interruption in the ignition path or a command error.

#### Procedure for recovering the misfire

( Drop the charge with the control point, wait 15 minutes and afterwards recover according to the locally valid regulations.

#### Prohibited (no go's)

Under no circumstances may the magazine-box with a suspended misfire be flown.



### 11.3.2 Type A1 (misfire hangs on tangled cord)

#### Assessment

The charge was dropped and hangs on tangled cord underneath the magazine-box. The tangling of the accessory cord has resulted in only one or neither of the percussion fuses 83 being pulled. From a distance, this can only be ascertained with difficulty through the two wire hooks attached to the cord, which are pulled out of the percussion fuses to activate triggering.

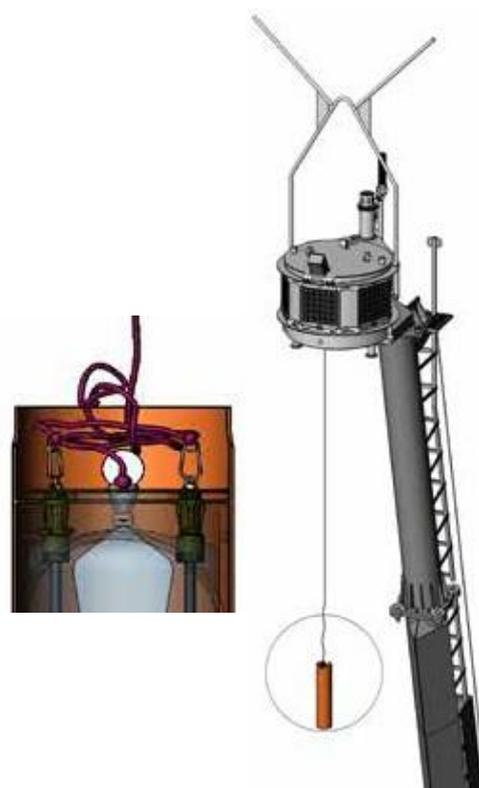
This is a misfire due to tangling of the retaining cord.

#### Procedure for recovering the misfire

( Drop the charge with the control point, wait 15 minutes and afterwards recover according to the locally valid regulations.

#### Prohibited (no go's)

- ( Under no circumstances may the magazine-box with a suspended misfire be flown.
- ( Under no circumstances may the misfire be fetched with a helicopter and long-line before dropping and defusing has been previously carried out.



### 11.3.3 Type B1 (misfire lies in the snow, percussion fuse pulled)

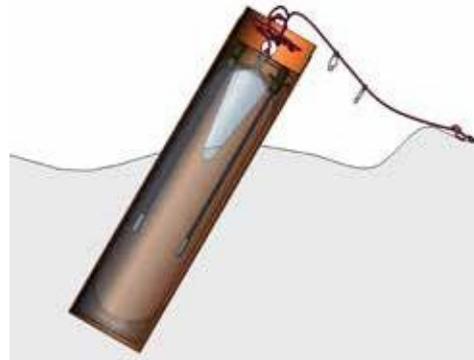
#### Assessment

The charge was dropped as usual for blasting, but did not detonate.

The percussion fuse 83 was pulled out by the drop, but the charge did not detonate. As a result, this is a misfire due an interruption in the ignition path or a command error.

This is apparent when the misfire lies in the snow, and the cord is attached and the wire hooks are visible.

If the charge was not manually dropped with the control point, then an additional technical problem exists. Please contact Support immediately.



#### Procedure for recovering the misfire

- ⌋ After the waiting interval of 15 minutes, the misfire can be securely recovered according to the prevailing regulations of the country.

#### Prohibited (no go's)

Under no circumstances may the cord lying on the ground be pulled.

### 11.3.4 Type B2 (misfire lies in the snow, percussion fuse not pulled)

#### Assessment

The percussion fuses 83 were not pulled due to malfunction in the magazine-box or due to a command error.

This is apparent when the misfire lies in the snow, and the cord is attached, but the wire hooks are not visible.

#### Procedure for recovering the misfire

- ⌋ After the waiting interval of 15 minutes, the misfire can be securely recovered according to the prevailing regulations of the country.

#### Prohibited (no go's)

Under no circumstances may the cord lying in the snow be pulled.



## 12 Emergencies

### 12.3.1 General remarks and delimita

The following scenarios describe emergencies with increased possibility of serious implications such as fatal consequences. In the case of emergency situations such as unintentional triggering of the primer during assembly of the charges etc., the person responsible for blasting draws up a safety concept and instructs the operating staff accordingly. Even if events occur without damage, the avalanche tower supplier is to be immediately informed.

### 12.3.2 Emergency as a result of a controlled avalanche release

Situations connected with controlled avalanche releases such as burying of persons and installations are not considered in these instructions. Personnel authorised for the operation of avalanche towers have received training in the appropriate behaviour patterns and must attend refresher courses.

### 12.3.3 Magazine-box falling during the helicopter transport

As a result of an emergency situation with the helicopter such as incorrect handling by the pilot, a technical fault with the helicopter or with the load-carrying equipment, a magazine-box falling either with or without explosives cannot be completely excluded. If such an event occurs, nobody may approach the fallen parts. The crash site is to be evacuated on a large scale, i.e. in an area of at least 1 km from any persons, cordoned off and safeguarded by checkpoints. The following departments are to be immediately alarmed:

- ( Responsible authorities (police)
- ( Supplier of the installation (Wyssen Avalanche Control AG)

These departments must determine further on-the-spot procedure together with the responsible blasting expert.

# 13 List of abbreviations

## Austro Control

Austro Control is responsible for safe and cost-effective procedure of air traffic in Austrian airspace, with up to 4,000 aircraft daily.

## BAKOM

The Swiss Federal Office of Communications BAKOM is a federal authority of the Swiss Confederation.

## BAZL

Swiss Federal Office of Civil Aviation (BAZL) is responsible for aviation development and for regulating civil aviation in Switzerland.

## FOM

Flight Operation Manual (FOM)

## Recco

RECCO is the trade mark of the search system for avalanche victims, which is globally distributed by the Company RECCO AB (Sweden). The RECCO system works with passive reflectors and active detection devices using the principle of harmonic radar. The reflectors require no individual energy supply and can thus be integrated inexpensively into winter sort clothing and equipment. The system can facilitate professional rescue teams in locating avalanche victims.

## SBFI

The State Secretariat for Education, Research and Innovation SBFI in the Federal Department for Economic Affairs, Education, and Research WBF is the federal centre of competence for nationally and internationally oriented questions for education, research and innovation policy.

## SLF

The duties of the WSL Institute for Snow and Avalanche Research SLF include research, scientific services, teaching and public relations.

In close connection with its research activities, the SLF also offers a range of services. These include consulting, expert opinions on avalanche accidents and avalanche protection, and the development of warning systems for natural hazards in the Alps. The best-known service is the avalanche bulletin or warning report for the Swiss Alps, which is published twice daily in wintertime.

## SUVA

The Swiss National Accident Insurance Fund Suva is the largest accident insurer in Switzerland. The independent institution incorporated under public law with its head office in Lucerne insures around 1.95 million employed people against industrial accidents, industrial illnesses and leisure accidents. Self-employed people can also insure themselves against the consequences of accidents with corporate insurance.

# 14 Glossary

## Main switch

Der Hauptschalter der Magazinkasten. Er befindet sich auf dem Steuerungsgehäuse im Magazin selbst. Er dient dazu, das ganze Magazin auszuschalten und stromlos zu machen.

## Holzer latch

The **Holzer** latch is a docking line on the helicopter, which has a latch on one end to hold objects. This latch can be opened and closed by the helicopter pilot himself.

## 15 Recommended literature

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  - [5] Schweizer, J., & andere. (2006). Lawinen und Recht. Proceedings zum Internationalen Seminar vom 6.–9. November 2005. Davos: WSL-Institut für Schnee- und Lawinenforschung SLF.
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  - [7] Wilhelm, C. (1999). Kosten-Wirksamkeit von Lawenschutzmassnahmen an Verkehrsachsen. Bern: Bundesamt für Umwelt, Wald und Landschaft BUWAL (heute BAFU - Bundesamt für Umwelt).
  - [8] S. Wyssen, S., Kindschi, J., & Feuerstein, G. (2011). Gonda avalanche case study: Controlled avalanche release with the Wyssen avalanche towers for protecting roads and railways. Reichenbach: Wyssen Avalanche Control AG

## **16 Annex**

- 16.1 Error list**
- 16.2 FOM “Flight Operation Manual”**
- 16.3 Regulations for the recovery of misfires (duds) in Austria**
- 16.4 Riomon T1 safety data sheet**
- 16.5 Declaration of conformity LS12-5**
- 16.6 Declaration of conformity HK-02**
- 16.7 Electrical diagram**

## 16.1 Error list

The errors can occur during blasting or a test run. The errors numbers are indicated on the operating panel or on the display in the magazine-box. For all errors please contact the technical service immediately.

<b>Faultno..</b>	<b>Description</b>
1	Time exceeded, hatch does not open.
2	No current is flowing in the motor.
3	The overcurrent protection is active.
4	Time exceeded, hatch does not open.
5	No current is flowing in the motor.
6	The overcurrent protection is active.
7	No current is flowing in the motor.
8	The overcurrent protection is active.
9	The switch for the charge detection is active.
10	The switch for the charge detection is active.
11	The switch for the dropping detection is inactive.
12	The deviation of the angle sensor is too high.
13	The pulse switch is active.
14	No current is flowing in the motor.
15	The overcurrent protection is active.
16	The pulse switch does not react.
17	The deviation of the angle sensor is too high.
18	The reference switch sticks.
19	The switch for the charge detection does not react.
20	The maximum rotation angle has been exceeded.
21	No current is flowing in the motor.
22	The overcurrent protection is active.
23	The switch for the charge detection has been activated.
24	The pulse switch does not react.
25	The deviation of the angle sensor is too high.
26	Time exceeded, no detonation detected.
27	Charge has not been dropped.
28	No current is flowing in the motor.
29	The overcurrent protection is active.
30	The next charge has been detected at the hatch.
31	The dropping switch sticks.
32	Error in the safety module.
33	Battery charge level too low.

## 16.2 FOM “Flight Operations Manual”

### 1. General information

#### A) Instruction of pilots and flight assistants

The pilots and flight assistants that are employed in transporting magazine-boxes to the Wysssen avalanche tower must previously have been instructed and made aware of the existing risks by the manufacturer.

#### B) Compliance with the safety measures

Pilots and flight assistants are entitled to and are required to refuse the flight order if there are any safety measures lacking, particularly concerning cordoning off and clearing of the receiving /unloading point.

#### C) System description

There is a detailed description of the Wysssen avalanche tower in the main report.

#### D) System safety

A monitoring sensor in the magazine-box switches on the main power supply to the charge dropping mechanism only if the magazine-box has been correctly positioned on the tower. Thus during a transport flight, no accidental triggering can occur.

#### E) Command centre status

For additional safety to the above point, the pilot must receive confirmation from the responsible blasting expert immediately before the flight, that the code list is inaccessible for all operators.

#### F) Magazine-box status

Prior to transportation, the pilot must receive confirmation from the customer's responsible blasting expert, that the charge dropping mechanism of the magazine-box is on stand-by, the dropping hole is closed and that the whole system is in perfect condition.

#### G) Helicopter latch status

The Wysssen helicopter latch, which is needed to clip into and lift the magazine-box from the tower, is to be inspected prior to each operation for its proper functioning and for any damage such as cracks. If any defects are found or if there are any uncertainties, the helicopter latch in question may not be used.

#### H) Regulations

The Explosives Act regulations (law on explosives, ordinance on explosives) and those of the explosives suppliers must be complied with.

#### I) Weather conditions

The wind and weather conditions have to be taken into consideration. If the conditions do not allow a safe flight manoeuvre, the transport must be postponed.

#### J) Crew

Only those people who have a directly concerned with the transport assignment may travel in the helicopter.

#### K) Flight route - safety corridor

Flying directly over densely populated areas, used roads as well as people, technical installations (e.g. mountain cableways, mountain restaurants and relay stations) and ski runs is prohibited.

The routes over which the magazine of the Wysssen avalanche blasting system is transported, may only run inside a safety corridor of 500 m. This means that the routes are to be selected, so that from the loading site to the avalanche tower, a distance of at least 500m in all directions is maintained from persons not immediately necessary for the operation. Transport flights with the specified system may only be carried out within the country borders.

#### L) Weight

The weight of the loaded magazine-box can be up to 700 kg (empty weight about 600 kg).

#### M) Due diligence

It is very important that the magazine-boxes are placed carefully onto the avalanche towers. If during the positioning manoeuvre, the magazine-box hits the tower heavily or is positioned jerkily, the internal mechanism may be damaged. This results in the subsequent operation to misfires, amongst other things. If the pilot or the responsible blasting personnel notice that the magazine-box has been set down extremely jerkily or has severely hit against the tower, this must be flown back down for inspection.

#### N) Emergency situations

If due to a technical fault, incorrect handling or an emergency situation, the magazine-box crashes to earth, nobody may approach the fallen parts. The pilot must immediately inform the local person responsible blasting expert, so that the necessary measures can be taken.

The crash site is to be evacuated on a large scale, i.e. in an area of at least 1 km from any persons, cordoned off and safeguarded by checkpoints. The responsible authorities (police/WFD), and the manufacturer of the installation (Wyssen Avalanche Control AG) must be notified.

## 2. Preparations

### A) Receiving point

The receiving point of the charged magazine-box must be flat and provide sufficient space for the flight manoeuvre. There must be a take-off and approach corridor available, so that no inhabited area or other areas occupied by people have to be flown over.

No objects are permitted in the area around the receiving point that under certain circumstances could activate the monitoring sensor in the insertion funnel of the magazine-box.

### B) Briefing

Prior to the first flight transport order, the pilot has to discuss the procedure and the particular dangers involved in this work with the specified ground staff. The personnel must also be instructed particularly in the operation of the load-carrying equipment (the latch) and the general dangers when flying external loads.

The pilot must make sure, that the endangered space is free of persons and vehicles and the checkpoints are manned for monitoring.

### C) Exploratory flight

Prior to the operation, an exploratory flight is to be made in accompaniment of the responsible blasting expert, to ensure that there are no uninvolved persons within the safety corridor.

### D) Personal protection equipment

The ground staff must wear the following protective equipment when attaching and detaching the magazine -box under the hovering helicopter: Helmet, safety goggles, gloves, suitable clothing and solid warm footwear.

### E) Uninvolved persons

There may be no uninvolved persons present at the loading/unloading point. If necessary, this is to be cordoned off.

### F) Communications check

Prior to starting work, a radio check for flawless communication is to be made between the pilot and the ground staff.

## 3. Placing the magazine-box on the tower

### A) Loading

The magazine-box is mounted directly onto the designated transport hanger with a mounting line and the electrical latch.

### B) Placing the magazine-box on the tower

The pilot brings the magazine-box with the insertion funnel vertically above the dockingsystem spike of the tower. Through lowering, this turns on its own into the correct position (towards the valley).

In newer installations, there is a flashing light on the magazine-box, which provides information to the pilot by flashing when the magazine-box has been correctly placed.

### C) Releasing the load

As soon as the pilot has determined that the magazine-box has turned into the correct position towards the valley, he can slacken the mounting line and actuate the electrical latch for release.

### D) Leaving the danger zone

After correctly placing the magazine-box on the tower, the pilot should quickly leave the danger zone of the avalanche blasting installation.

#### 4. Return transport of the magazine box

##### A) Explosive charges

Prior to the return transport, the pilot must find out whether there are any live charges still in the magazine-box.

##### B) Transport hangers

For the return transport, the Wyssen helicopter latch is attached to the mounting line with the electrical latch, so that the pilot can attach the magazine-box on the tower on his own.

##### C) Loading

The magazine-box can be attached by the pilot himself by bringing the fork of the Wyssen helicopter latch over the transport hanger on the magazine-box. The latch opens when lowered and then afterwards closes automatically.

##### D) Lifting the magazine-box off the tower

The pilot must hover exactly vertically over the magazine-box and then climb at least 1 m so that the magazine-box is released from the docking system spike.

It may be that for the newer installations, the mounted light begins to flash, but this is of no significance.

## 16.3 Regulations of recovery of misfires (duds)

### Misfire recovery for Austria

Analogously adopted and adapted from the Austrian Ordinance on Blasting Operations and for the regulations for blasting avalanches from the helicopter.

#### Recovery of misfires (duds):

- ( Misfires are to be recovered after at least 15 minutes and without any unnecessary delay. Misfires are to be professionally defused after recovery.
- ( Charges that are still hanging on the cord and/or are attached to the magazine-box may not be touched. In this case, procedure must be followed as described in chapter 9.6 item 2 by dropping the charge deliberately. A blasting expert should observe from a distance where the charge has dropped, so that its subsequent recovery is facilitated. After dropping the misfire, a further 15 minutes at least should be waited.
- ( If the danger of avalanches is high, the personnel can be brought by helicopter to the location of the misfire on a line.
- ( This has to be performed by the avalanche blasting expert and trained rescue personnel under the following prerequisites:
- ( Utilisation of a two-motor helicopter (performance class 1 Cat A approval) and suitable recovery line or officially approved winch.
- ( Utilisation of a suitable safety harness with a standard-conforming safety carabiner.
- ( Utilisation of a safety helmet, equipped with a fixed transmitter and receiver system with microphone and earphones.
- ( Posting the avalanche blasting expert and the rescue personnel at the recovery site is prohibited.
- ( If an immediate recovery due to avalanche danger and poor weather conditions is not possible, the danger area of the explosive charge and possible avalanches is to be secured against uninvolved persons.
- ( Any remaining, live explosive charges are to be defused immediately after blasting operations or after the misfire has been recovered, in compliance with all necessary safety measures.

# 16.4 Data Sheet Riomon T1

## SICHERHEITSDATENBLATT

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<b>Produkt:</b>		<b>RIOMON T1</b>				
<b>1. Stoff-/Zubereitungs- und Firmenbezeichnung</b>						
1.1	<b>Handelsname:</b>	RIOMON T1				
1.2	<b>Hersteller/Lieferant:</b>	MAXAM Deutschland GmbH Werk Sythen Werkstraße 111 D-45721 Haltern am See	Telefon (02364) 689 - 0 Telefax (02364) 689 208			
1.3	<b>Auskunft/Notfallauskunft:</b>	Produktionsleitung/Bereitschaft MAXAM Deutschland, Werk Sythen	Telefon (02364) 689 - 0 Telefax (02364) 689 208			
<b>2. Zusammensetzung / Angaben zu Bestandteilen</b>						
2.1	<b>Chemische Charakterisierung:</b> Pulverförmiger Sprengstoff, wasserfest					
2.2	<b>Gefährliche Inhaltsstoffe:</b>					
	<i>Bezeichnung</i>	<i>CAS - Nr.</i>	<i>Gehalt</i>	<i>Einheit</i>	<i>Kennbuchstaben</i>	<i>R- Sätze</i>
	Ammoniumnitrat	6484-52-2	85,0 - 89,0	%	O	-
2.3	<b>Zusätzliche Hinweise:</b> Klartexte der R-Sätze siehe unter Abschnitt 15 und 16.					
<b>3. Mögliche Gefahren</b>						
3.1	<b>Besondere Gefahrenhinweise für Mensch und Umwelt:</b> - Durch Schlag, Reibung, Feuer oder andere Zündquellen explosionsgefährlich - Gesundheitsschädlich beim Einatmen, Verschlucken und bei Berührung mit der Haut					
	<b>Gefahrenhinweise:</b> Die Angaben beschränken sich auf den Umgang mit der unpatronierten Masse.					
<b>4. Erste-Hilfe Maßnahmen</b>						
4.1	<b>Allgemeine Hinweise:</b> Helfer auf Selbstschutz achten. Ärztliche Hilfe erforderlich bei Symptomen, die offensichtlich auf das Einatmen von Verbrennungsgasen zurückzuführen sind. Vergiftungssymptome müssen nicht sofort auftreten. Bei Gefahr der Bewußtlosigkeit Lagerung und Transport in stabiler Seitenlage. Verletzten schnellstens aus Gefahrenbereich bringen. Patienten sollten mindestens 48 Stunden unter ärztlicher Aufsicht bleiben.					
4.2	<b>Nach Einatmen von Verbrennungsgasen:</b> Verletzten an frische Luft bringen, Arzt konsultieren. Bei Atemstillstand: Atemspende ggf. Sauerstoffzufuhr; baldmöglichst Dexamethason-Spray (z.B. Auxilison) inhalieren lassen, sofort ärztliche Behandlung veranlassen.					
4.3	<b>Nach Augenkontakt:</b> Augen mehrere Minuten bei geöffnetem Lidspalt unter fließendem Wasser spülen, ggf. Arzt konsultieren.					
4.4	<b>Nach Hautkontakt:</b> Mit Wasser und Seife gründlich abwaschen.					

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<b>Produkt:</b>	<b>RIOMON T1</b>
<b>5. Maßnahmen zur Brandbekämpfung</b>	
<b>5.1 Geeignete Löschmittel:</b>	Bei Umgebungsbränden mit Wasser, Wassersprühstrahl oder Löschpulver löschen. Unter allen Umständen verhindern, daß Brand das Produkt erfaßt.
<b>5.2 Besondere Gefährdung durch den Stoff, seine Verbrennungsprodukte oder entstehende Gase:</b>	Im Brandfall Explosionsgefahr. Keine Lösversuche, wenn Brand das Produkt erfaßt hat; sichere Deckung (ca. 300 m) aufsuchen, Umgebung warnen ggf. evakuieren. Im Brand- oder Explosionsfalle Bildung von giftigen Stickstoffoxiden (Lungenödemgefahr).
<b>5.3 Besondere Schutzausrüstung:</b>	Im Brandfalle umluftunabhängigen Atemschutz und dichte Schutzkleidung tragen. Brandbekämpfung nur aus gesicherter Deckung.
<b>6. Maßnahmen bei unbeabsichtigter Freisetzung</b>	
<b>6.1 Personenbezogene Vorsichtsmaßnahmen:</b>	Berührung der Augen und der Haut vermeiden. Unbefugte Personen fernhalten. Bei Aufräumarbeiten nicht essen, trinken, rauchen. Absperrung erforderlich. Geeignete Schutzkleidung und Schutzausrüstung benutzen (siehe Punkt 8.2).
<b>6.2 Verfahren zur Reinigung/Aufnahme:</b>	Von Hand unter Verwendung von Holzschaukeln / funkensicherem Werkzeug aufnehmen und ausschließlich in gekennzeichnete, abdeckbare Behälter füllen. Bei Regen Produkt mit Plane abdecken. Nicht in die Kanalisation/Gewässer gelangen lassen.
<b>6.3 Zusätzliche Hinweise:</b>	Kontaminiertes Material und Verpackung als Abfall nach Punkt 13 entsorgen.
<b>7. Handhabung und Lagerung</b>	
<b>7.1 Handhabung:</b>	
<b>7.1.1 Hinweise zum sicheren Umgang:</b>	Der Umgang mit Sprengstoffen ist nur den nach Sprengstoffgesetz berechtigten Personen oder unter deren Aufsicht erlaubt. Unter Verschuß aufbewahren. Vor Feuchtigkeit schützen. Nur verpackt lagern und transportieren. Vor Hitze schützen. Verpackung mit Vorsicht öffnen und handhaben. Schlag und Reibung vermeiden. Funkensicheres, anistatisches Werkzeug verwenden Für gute Raumbelüftung sorgen. Dämpfe nicht einatmen. Bei der Arbeit nicht essen, trinken, rauchen. Kontakt mit den Augen und der Haut vermeiden. Persönliche Schutzausrüstung siehe unter 8.2.
<b>7.1.2 Hinweise zum Brand- und Explosionsschutz:</b>	Zündquellen fernhalten, nicht rauchen. Schlag und Reibung vermeiden. Bei spontaner Erwärmung sichere Deckung aufsuchen, Umgebung warnen.
<b>7.2 Lagerung:</b>	Die Lagerung bedarf einer Genehmigung gemäß nationaler Vorschriften.
<b>7.2.1 Anforderung an Lagerräume und Behälter (Deutschland):</b>	Die Lagerung bedarf der Genehmigung gemäß SprengG. Lagergruppe: 1.1 D (2. SprengV) Lagerung nur in versandmäßiger Verpackung
<b>7.2.2 Zusammenlagerungshinweise (Deutschland):</b>	Vgl. Zweite Verordnung zum Sprengstoffgesetz (2. SprengV) und Sprengstofflagerrichtlinien.

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**Produkt: RIOMON T1**

**8. Expositionsbegrenzung und persönliche Schutzausrüstungen**

**8.1 Bestandteile mit arbeitsplatzbezogenen, zu überwachenden Grenzwerten:**  
-entfällt

**8.2 Persönliche Schutzausrüstung:**

**8.2.1 Allgemeine Schutz- und Hygienemaßnahmen:**  
Von Nahrungsmitteln und Getränken fernhalten. Berührung der Augen und der Haut mit unpatronierter Sprengstoffmasse vermeiden. Vor den Pausen und bei Arbeitsende Hände waschen.

**8.2.2 Atemschutz:**  
Nicht erforderlich.

**8.2.3 Handschutz:**  
Bei unverpacktem Material Handschuhe aus Gummi oder Kunststoff, bei verpacktem Material nicht erforderlich.

**8.2.4 Augenschutz:**  
Nicht erforderlich.

**8.2.5 Körperschutz:**  
Arbeitsschutzkleidung aus Baumwolle.

**9. Physikalische und chemische Eigenschaften**

**9.1 Erscheinungsbild:**

**9.1.1 Form:** pulverförmig  
**9.1.2 Farbe:** grau  
**9.1.3 Geruch:** nahezu geruchlos

**9.2 Sicherheitsrelevante Daten:**

	Wert/Bereich	Einheit	Methode
<b>Thermische Zersetzung</b>	ab 161	°C	VDE 0166 (BAM)
<b>Patronendichte</b>	1,0 – 1,15	g/cm <sup>3</sup>	DIN 20 164
<b>Dampfdruck bei 20°C</b>			
Glykol	0,08	hPa	
<b>Löslichkeit in Wasser bei 20°C</b>			
Ammoniumnitrat	650	g/dm <sup>3</sup>	
Glykol	1000	g/dm <sup>3</sup>	
<b>pH-Wert</b>	6,0 - 7,0	(wässriger Auszug)	

**10. Stabilität und Reaktivität**

**10.1 Zu vermeidende Bedingungen/Gefährliche Reaktionen:**  
Erhitzen, Schlag, Reibung vermeiden. Explosionsgefahr.

**10.2 Gefährliche Zersetzungsprodukte:**  
Stickstoffoxide (nitrose Gase); Kohlenmonoxid.

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<b>Produkt:</b>	<b>RIOMON T1</b>								
<b>11. Angaben zur Toxikologie</b>	<p>Durch Einatmen von Verbrennungsgasen: Gefahr der Bildung eines Lungenödems</p> <p><b>Akute Toxizität der Komponente:</b></p> <p><b>Ammoniumnitrat:</b> LD<sub>50</sub> oral, Ratte &gt;2000 mg/kg</p>								
<b>12. Angaben zur Ökologie</b>	<p>Wassergefährdung bei verpacktem Produkt ausgeschlossen. Die unpatronierte Masse ist schwach wassergefährdend (Selbsteinschätzung). WGK 1</p> <p>Uns liegen folgende ökotoxikologische Bewertungen vor:</p> <table><tr><td>Ammoniumnitrat</td><td>LC<sub>50</sub> (96 h)</td><td>1000 mg/dm<sup>3</sup></td><td>(daphnia magna)</td></tr><tr><td></td><td><b>WGK</b></td><td>1</td><td>(schwach wassergefährdend)</td></tr></table>	Ammoniumnitrat	LC <sub>50</sub> (96 h)	1000 mg/dm <sup>3</sup>	(daphnia magna)		<b>WGK</b>	1	(schwach wassergefährdend)
Ammoniumnitrat	LC <sub>50</sub> (96 h)	1000 mg/dm <sup>3</sup>	(daphnia magna)						
	<b>WGK</b>	1	(schwach wassergefährdend)						
<b>13. Hinweise zur Entsorgung</b>	<p>Unbrauchbare Sprengstoffe und kontaminierte Verpackung müssen in gesicherter Weise unter Berücksichtigung nationaler Vorschriften beseitigt oder einer Sonderbehandlung zugeführt werden. Sie sind möglichst dem Hersteller zurückzuführen.</p> <p>Abfallschlüssel (EAK) – <b>16 04 03</b> Andere verbrauchte Sprengstoffe</p> <p><b>Entsorgung/Vernichtung - Produkt/Verpackung - Vorschriften:</b></p> <p><i>Zerlegen von Gegenständen mit Explosivstoff oder Vernichten von Explosivstoff oder Gegenständen mit Explosivstoff (BGR 114)</i></p> <p><i>Explosivstoffe – Allgemeine Vorschrift (BGV B 5)</i></p> <p><i>Sprengarbeiten (BGV C 24)</i></p> <p>Die Entsorgung/Vernichtung darf nur durch berechtigte Personen auf genehmigtem Brand- und Sprengplatz durchgeführt werden.</p>								
<b>14. Angaben zum Transport</b>									
<b>14.1 Landtransport ADR / RID und GGVS / GGVE (grenzüberschreitend und Inland):</b>									
<b>Klasse:</b>	1.1 D								
<b>Verpackungsgruppe:</b>	II								
<b>Gefahr Nr.:</b>	Nicht anwendbar								
<b>UN-Nr.:</b>	0082								
<b>Bezeichnung:</b>	Sprengstoff Typ B, RIOMON T 1								

# SICHERHEITSDATENBLATT

gemäß EG Nr. 1907/2006



überarbeitet am 13.02.2012

Seite 5 von 5

## Produkt: RIOMON T1

### 142 Seeschifftransport IMDG/GGVSee (IMDG code):

**Klasse:** 1.1 D

**UN-Nr.:** 0082

**EMS-Nr.:** F-B, S-Y

**Richtiger technischer Name:** EXPLOSIVE, BLASTING, TYPE B

### 143 Lufttransport ICAO-TI und IATA-DGR:

Verboten

## 15. Vorschriften

### 15.1 Kennzeichnung nach EG-Richtlinien:

#### 15.1.1 Kennbuchstabe und Gefahrenbezeichnung des Produktes:

**E** - Explosionsgefährlich

#### 15.1.2 Gefahrenbestimmende Komponenten:

**Enthält:** Ammoniumnitrat

#### 15.1.3 R - Sätze:

**R 2** - Durch Schlag, Reibung, Feuer oder andere Zündquellen explosionsgefährlich

**R 20/21/22** - Gesundheitsschädlich beim Einatmen, Verschlucken und bei Berührung mit der Haut

#### 15.1.4 S - Sätze:

**S 1** - Unter Verschluss aufbewahren

**S 35** - Abfälle und Behälter müssen in gesicherter Weise beseitigt werden

**S 36** - Bei der Arbeit geeignete Schutzkleidung tragen

**S 41** - Explosions- und Brandgase nicht einatmen

**S 45** - Bei Unfall oder Unwohlsein sofort Arzt hinzuziehen (wenn möglich, dieses Etikett vorzeigen)

### 15.2 Nationale Vorschriften:

Das Produkt ist nach der derzeit gültigen Gefahrstoffverordnung nicht kennzeichnungspflichtig.

### 15.3 Wassergefährdungsklasse:

WGK 1 (Selbsteinstufung), schwach wassergefährdend

## 16. Sonstige Angaben

### 16.1 Klartext weiterer R-Sätze aus Abschnitt 2:

**R 44** - Explosionsgefahr bei Erhitzen unter Einschluss

### 16.2 Weitere Informationen:

Die Angaben im Sicherheitsdatenblatt geben den derzeitigen Kenntnisstand über unsere Produkte wieder. Das Sicherheitsdatenblatt dient der Produktbeschreibung im Hinblick auf den Umgang und auf die sicherheitsrelevanten Erfordernisse. Es werden damit keine verbindlichen Zusagen über vertraglich vereinbarte Produkteigenschaften abgegeben. Bestehende Gesetze und Bestimmungen sind vom Empfänger unseres Produktes in eigener Verantwortung zu beachten.

Dieses Sicherheitsdatenblatt wurde EDV-technisch erstellt und somit nicht unterschrieben.

RIOMON T1

## 16.5 CE-Conformity LS 12-5

### CE-KONFORMITÄTSERKLÄRUNG FÜR MASCHINEN

Entspricht Maschinenrichtlinie 2006/42/EG Anhang II A

Wir,

Wyssen Avalanche Control AG  
Feld 1  
CH-3713 Reichenbach i.K.

Erklären hiermit, dass das Produkt  
Typ

Sprengmast LS12-5  
411.100D

allen grundlegenden  
Anforderungen der  
nebenstehenden Richtlinien  
entspricht:

2006/42/EG mit deren Änderungen  
2004/108/EG

Bevollmächtigte Person für das  
Zusammenstellen der technischen  
Unterlagen gemäss Anhang VII A  
der Richtlinie 2006/42/EG:

Wyssen Avalanche Control AG  
Benjamin Meier  
Feld 1  
CH-3713 Reichenbach i.K.

Angewendete Normen:

EN ISO 13849, EN 60204-1, EN 61784-3,  
EN 61000-6-3:2007 + A1:2011+AC:2012,  
IEC 61000-6-3:2006 + A1:2010,  
EN 61000-6-2:2005,  
IEC 61000-6-2:2005 (ed2.0),  
ETSI EN 301 489-1:2011 & -3:2013,  
ETSI EN 301 489-7:2005 & -24:2010,  
EN 50272-2

Reichenbach i.K., 5. März 2016

  
Samuel Wyssen, CEO

  
Christian Wyssen, COO

## 16.6 CE-Conformity HK-02

### CE-KONFORMITÄTSERKLÄRUNG FÜR MASCHINEN



Wir, Wyssen Avalanche Control AG  
Feld 1  
CH-3713 Reichenbach

erklären hiermit, dass das Produkt Wyssen Heliklinke  
HK-02  
Typ 411.600C  
Seriennummer

allen grundlegenden 2006/42/EG  
Anforderungen der mit deren Änderungen  
nebenstehenden Richtlinien  
entspricht:

Bevollmächtigte Person für das Wyssen Avalanche Control AG  
Zusammenstellen der technischen Christian Zumbach  
Unterlagen gemäss Anhang VII A Feld 1  
der Richtlinie 2006/42/EG: CH – 3713 Reichenbach

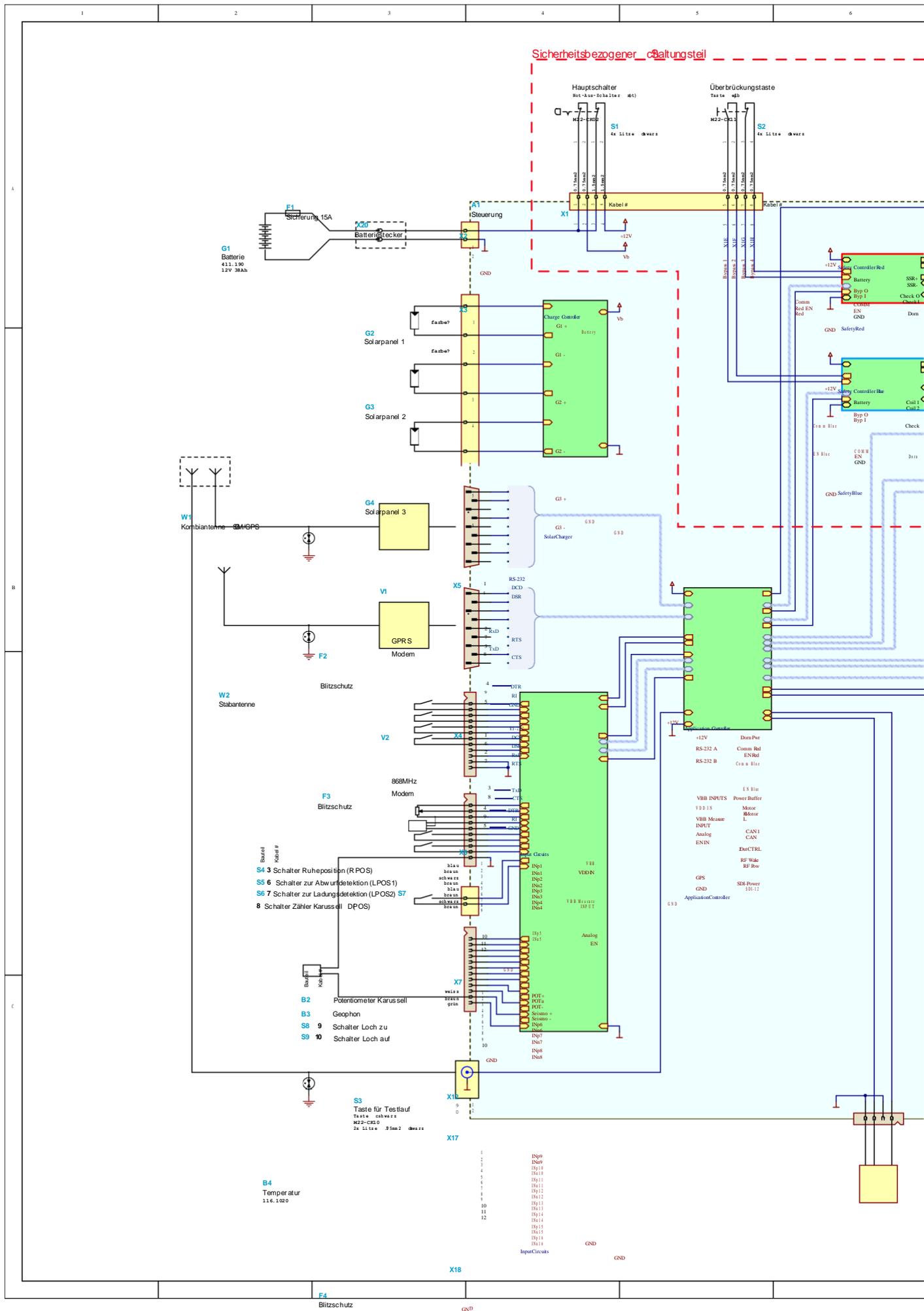
Konformitätsbewertungsstelle für SUVA  
die Durchführung der Bereich Technik  
Baumusterprüfung: Zertifizierungsstelle SCESp 008  
Europäisch notifiziert, Kenn-Nr. 1246  
Postfach 4358  
CH-6002 Luzern

Baumusterprüfbescheinigung Nr.: E 7075.e

Angewendete Normen: EN 13155:2003+A2, EN ISO 12100

Reichenbach, 05.11.2014

Sam Wyssen, CEO



Sicherheitsbezogener c&altungsteil

G1 Batterie  
411.190  
12V 36Ah

F1 Sicherung 15A

Batteriestecker

Steuerung

G2 Solarpanel 1

G3 Solarpanel 2

G4 Solarpanel 3

V1 GPRS Modem

V2 968MHz Modem

F3 Blitzschutz

Blitzschutz

W2 Stabantenne

W1 Kommbatterie

Blitzschutz

S4 3 Schalter Ruheposition (R POS)

S5 6 Schalter zur Abwurfdetektion (L POS1)

S6 7 Schalter zur Ladungsdetektion (L POS2) S7

S8 8 Schalter Zähler Karussell D POS)

B2 Potentiometer Karussell

B3 Geophon

S8 9 Schalter Loch zu

S9 10 Schalter Loch auf

S3 Taste für Testlauf

B4 Temperatur

116.1020

F4 Blitzschutz

Hauptschalter

Überbrückungstaste

Kabel #

1

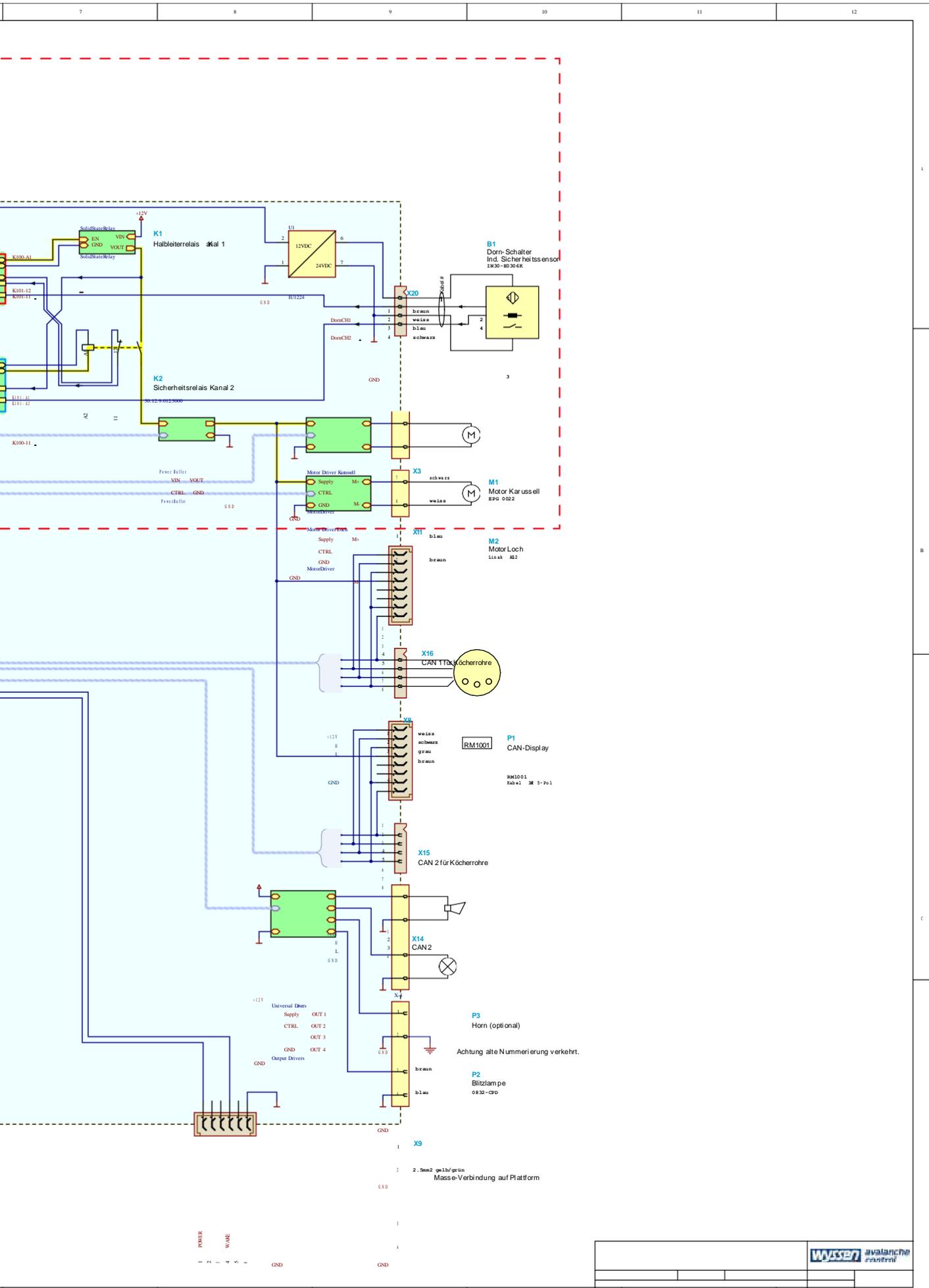
2

3

4

5

6



X13  
Speisung Modem





**In Switzerland:**

Wyssen Avalanche Control AG  
CH-3713 Reichenbach i.K.

Tel.: +41 033 676 76 76

E-mail: [avalanche@wyssen.com](mailto:avalanche@wyssen.com)

**In Canada:**

Wyssen Avalanche Control Inc  
AT-???? ????????????

Tel.: +

E-mail: [canada@wyssen.com](mailto:canada@wyssen.com)

For further information  
Visit us at  
[www.wyssenavalanche.com](http://www.wyssenavalanche.com)



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Violations incur an obligatory payment of damages

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### III. APPENDICES

#### APPENDIX A- AVALANCHE AREA LOCATIONS BY PROGRAM

Avalanche Program	Avalanche Area Name	Avalanche Program	Avalanche Area Name
Central	APEX MT.	Kootenavs	COFFEE CREEK
Central	BARRIERE	Kootenavs	BLUEBERRY-PAULSON
Central	BELLA COOLA	Kootenavs	CAPE HORN BLUFFS
Central	CHASE	Kootenavs	CASTLEGAR BLUFFS
Central	COALMONT	Kootenavs	FERNIE
Central	MONASHEE PASS · ECHO LK	Kootenavs	GRAND FORKS NORTH
Central	PINE PASS	Kootenavs	HILLS-SUMMIT LAKE
Central	PRINCETON NORTH	Kootenavs	LARDEAU
Central	RED PASS	Kootenavs	NAKUSPNORTH
Central	WELLS-BOWRON LAKES	Kootenavs	NAKUSP SOUTH
		Kootenavs	NAKUSP-HOT SPRINGS RD
		Kootenavs	NEW DENVER-KASLO
		Kootenavs	SEVEN MILE DAM
		Kootenavs	SHEEP CREEK
		Kootenavs	SILVERTON
		Kootenavs	ST. MARYS
		Kootenavs	TOBY CREEK
		Kootenavs	VALLICAN BLUFFS
		Kootenavs	WHITEWATER
Coast Chilcotin	BRIDGE RIVER	North West	CASSIAR
Coast Chilcotin	CHEAKAMUS CANYON	North West	DORIS LAKE
Coast Chilcotin	CYPRESS	North West	GREENVILLE-KINCOLITH
Coast Chilcotin	DUFFEY LAKE	North West	MOOSE PASTURE
Coast Chilcotin	BIG SLIDE	North West	NINGUNSAW PASS
Coast Chilcotin	MARBLE CANYON	North West	SHAMES
Coast Chilcotin	PEMBERTON-DARCY	North West	TELEGRAPH CREEK
		North West	TERRACE - KITWANGA
		North West	TERRACE - TYEE
Columbias	GALENA PASS	Kootenay Pass	HWY 3
Columbias	GREENSLIDE		
Columbias	HWY23NORTH		
Columbias	HWY 31 S-TROUT LAKE		
Columbias	KICKING HORSE CANYON		
Columbias	TRANS CANADA HWY WEST		
Columbias	TRANS CANADA HWY EAST		
North Cascades	ALLISON PASS		
North Cascades	COQUIHALLA		
North Cascades	FRASERCANYON		
North Cascades	HEMLOCK VALLEY		
North Cascades	MT. CHEAM FLOODS		
North Cascades	BOTANIE MOUNTAIN		
Bear Pass	HWY 37A		

### **III. APPENDICES**

APPENDIX B – WSBC SAFETY FUSE ASSEMBLY VARIANCE: VR202100063



**OHS Practice and Engineering Support**

**Mailing address:** PO Box 5350 Stn Terminal, Vancouver BC V6B 5L5  
P 604.231.8644 | 1.888.621.7233 | F 604.276.3101 | [worksafebc.com](http://worksafebc.com)

July 26, 2021

Val Visotzky  
Avalanche Program Supervisor  
Rocky Mountain District  
Ministry of Transportation and Infrastructure  
555 Victoria Road, PO Box 710,  
Revelstoke, BC V0E 2S0

Dear Mr. Visotzky,

**Your request for a Variance – VR202100063**

In your letter of March 15, 2021, you requested a variance to section 21.56(2) of the Occupational Health and Safety Regulation (OHSR) to allow the reduction of the Safety fuse assemblies from 1 m (3.3 ft) in length to 30 cm (11.8 inches) in length for use in the Avalanche Guard and Wyszen Towers.

Your application for a variance has been authorized pursuant to the terms set out in the attached variance order. The variance has been issued under section 60 of the *Workers Compensation Act* on the basis that the variance has substantially the same purpose and effect as the provision being varied.

Please call me at 604-233-4071 if you have any questions concerning the variance process or the review of your submission.

The *Workers Compensation Act* section 268 allows a person affected by this decision to request a formal review of the decision. Affected persons may include an employer, worker, owner, supplier or union. To exercise this right, a written request will need to be submitted to the Review Division within 45 days.

NOTE: The Review Division can be contacted at 604-214-5411 or toll free at 1-888-922-8804. Information is also available on the WorkSafeBC website at [http://www.worksafebc.com/claims/review\\_and\\_appeals/default.asp](http://www.worksafebc.com/claims/review_and_appeals/default.asp).

The Employers' Advisors office of the Ministry of Jobs, Tourism and Skills Training and Responsible for Labour is available to provide advice or assistance to employers. Their telephone number is 604-713-0303, or toll free at 1-800-925-2233.

The Workers' Advisors office of the Ministry of Jobs, Tourism and Skills Training and Responsible for Labour is available to provide advice or assistance to workers. Their telephone number is 604-713-0360, or toll free at 1-800-663-4261.

Yours truly,

Shelley Baldry  
Senior Prevention Advisor  
OHS Practice and Engineering Support  
Prevention Services  
WorkSafeBC

Copies to: Katie Ward, Employer Co-chair, Ministry of Transportation and Infrastructure  
Cliff Razzo, Worker Co-chair, Ministry of Transportation and Infrastructure  
Wendy Mah, Union Representative, BCGEU Local 205  
BCGEU Occupational Health and Safety Department  
Warren Fulton, Certification Officer, Certification Services  
Angelique Prince, Manager, Certification Services  
Terry Bertram, Manager, Prevention Field Services  
Mark Harper, Occupational Safety Officer, Prevention Field Services  
Firm File: Ministry of Transportation and Infrastructure – 4000-175

Enclosure(s)

## **TERMS OF VARIANCE – VR202100063**

<b>Regulation</b>	<p>A variance is granted to the requirement in section 21.56(2) of the <i>Occupational Health and Safety Regulation</i> that states:</p> <p style="text-align: center;"><b>21.56 Safety fuse assemblies</b></p> <p>...</p> <p>(2) Safety fuse assemblies less than 1 m (3.3 ft) in length must not be used.</p> <p>Granting this variance to the section(s) listed above does not relieve the employer of a duty to ensure compliance with all other sections of the <i>Occupational Health and Safety Regulation</i> and the <i>Workers Compensation Act</i>.</p>
<b>Date granted</b>	July 26, 2021
<b>Responsibility</b>	The variance is granted to the employer, Ministry of Transportation and Infrastructure, Firm No. 4000-175, who has responsibility to ensure that these terms are complied with.
<b>Jobsite/ work process</b>	The variance is only applicable to the use of The Avalanche Guard in use on Mt. Fortitude and the Wyssen towers in use at Three Valley Gap. The commissioning of Wyssen Towers and Avalanche Guard must be as laid out in the Explosive Use Operational Plan (BC Ministry of Transportation Avalanche and Weather Programs, 2021).
<b>Special terms</b>	<p>The conditions and procedures set out in your letter of March 15, 2021, which is attached, must be complied with, as well as the following:</p> <ol style="list-style-type: none"><li>1. The Blaster of Record must hold a valid Avalanche Control blasting certificate.</li><li>2. The Blaster of Record must exercise continuous visual supervision over any assistants who may be involved with preparation, loading and firing of these devices.</li><li>3. Only personnel required to load or unload the Wyssen Tower deployment box are to be on site. The number of personnel on site must not exceed 6 people, including any persons in training.</li><li>4. Only personnel required to load or unload the Avalanche Guard are to be on site. The number of personnel on site must not exceed 4 people, including any persons in training.</li><li>5. Safety fuse assemblies must not be trimmed until just prior to assembling the charges.</li><li>6. Unused trimmed safety fuse assemblies must be destroyed as per manufacturer's instructions.</li><li>7. The initiation of the Avalanche Guard or Wyssen Tower must be from a remote location by a Blaster of Record who holds a valid Avalanche Control Blasting Certificate.</li><li>8. Manufacturer's misfire procedures must be used in event of a failure to detonate.</li></ol>

## **TERMS OF VARIANCE – VR202100063**

9. In the event of a misfire being in the avalanche snow pack, a minimum of a 30-minute wait must be observed after all snow has stopped moving before permitting anyone to enter the danger area.
10. All members of the helicopter crew, including the pilot, must have TDG certificates.
11. Under normal circumstances at the end of the season, prior to removing the Wyssen Tower deployment box, it must be emptied by detonating any leftover product in the box.
12. Prior to detonating the leftover product, 72-hour notice must be given to local WorkSafeBC and RCMP offices.
13. Accidental Ignition procedures must be practiced with a dummy round at the beginning of the season and again if any new team members (workers) come on site. The training must be documented.
14. All required phone numbers listed in written procedures must be checked and confirmed prior to transporting any explosives.

**Posting**

A copy of these terms, along with any documents to which they refer, must be maintained at the worksite and be available for inspection by WorkSafeBC officers. The same documents must be posted on a suitable bulletin board in legible condition for the period of the variance. If affected workers will not receive notice by posting on a bulletin board, then the variance must be otherwise made known to all affected workers.

**Joint committee**

A copy of these terms, along with any documents to which they refer, must be given to the Joint Occupational Health and Safety Committee or to the Worker Health and Safety Representative, as applicable.

**Time limited**

This variance will be valid for five (5) years from the date of this letter, to July 26, 2026.

**Verification**

The worksite may be inspected by WorkSafeBC officers to confirm these terms are being met.

**Failure to comply**

If the terms and conditions of this variance order are not met, the order is without effect and the applicable sections of the *Occupational Health and Safety Regulation* apply. Any non-compliance with the terms and conditions of this variance order, or other infractions relating to the subject matter of the variance, may also result in imposition of orders and administrative penalties.

**Validity**

The granting of this variance is based on the completeness and accuracy of the information provided to WorkSafeBC. Any failure to have provided complete and accurate information may result in revocation of the variance and imposition of orders and administrative penalties.

**Reconsider**

WorkSafeBC may reconsider the granting of the variance, or its terms, if it is later found to have been granted in error, new information is received since it was granted or the applicable *Occupational Health and Safety Regulation* provisions are substantively amended.

## **TERMS OF VARIANCE – VR202100063**

**Re-application** Application for another variance upon the expiry of this variance must be made to the Senior Prevention Advisor, OHS Practice and Engineering Support.

Future variance applications can be expedited if the firm's application includes letters from the union and the relevant Joint Occupational Health and Safety Committee or Worker Health and Safety Representative setting out their position in relation to the application.



---

Shelley Baldry  
Senior Prevention Advisor  
OHS Practice and Engineering Support  
Prevention Services  
WorkSafeBC



**To:** WorkSafeBC Prevention Practices and Quality  
PO Box 5350 Stn Terminal  
Vancouver, BC V6B 5L5

**From:** Val Visotzky  
Avalanche Program Supervisor  
Rocky Mountain District  
Ministry of Transportation and Infrastructure  
250-806-6773, 250-837-8795  
Val.Visotzky@gov.bc.ca  
PO box 710, Revelstoke, BC  
V0E 2S0

**Date:** March 15, 2021

**RE:** Variance request for Section 21.56(2) of the OHSR  
This letter is submitted to request a renewal of variance **VR-201600107** from Section 21.56(2) of the Occupational Health and Safety Regulations that states: *Safety fuse assemblies less than 1m (3.3 ft) in length must not be used.* This variance will be used by Ministry of Transportation and Infrastructure and is specific to the Wyssen Avalanche Tower and Avalanche Guard Remote Avalanche Control Systems, for which the manufacturers requires the use of a 30 cm safety fuse assembly (SFA).

This request regards the use of The Avalanche Guard in use on Mt. Fortitude and Wyssen towers in use at Three Valley Gap.

The Wyseen Avalanche and Avalanche guard Towers are remote avalanche control systems that are deployed by an avalanche technician from a safe location (e.g. highway) using a tablet, phone or laptop computer and an encrypted communication system. Since the explosives are deployed remotely during closure of the highway, a shorter fuse does not compromise worker or public safety, all of whom are located outside of the blasting danger area when the SFA is ignited. Due to limited space in the deployment boxes, a 30 cm fuse must be used to prevent crossing fuse loops and interference with charge deployment.

Explosive use procedures are submitted separately to WorkSafe BC for approval. These procedures describe personnel training and supervision, assembly and loading of explosives, transportation of the deployment box by helicopter, deployment of explosives using the remote system, and misfires. Procedures are detailed to meet requirements of Worksafe BC Regulations, Part 21 – Blasting Operations.

Val Visotzky

November 3, 2016

Val Visotzky  
Avalanche Technician  
Rocky Mountains District  
Ministry of Transportation and Infrastructure  
PO Box 710  
Revelstoke, BC V0E 2S0

Dear Mr. Visotzky:

**Your request for a Variance – VR201600107**

In your letter of August 23, 2016, you requested a variance to section 21.56(2) of the *Occupational Health and Safety Regulation* (OHSR) to reduce safety fuse assemblies from 1 m (3.3 feet) in length to 30 cm (11.8 inches) in length for use in the Avalanche Guard and Wyssen Towers.

Your application for a variance has been authorized pursuant to the terms set out in the attached variance order. The variance has been issued under section 164 of the *Workers Compensation Act* on the basis that the variance has substantially the same purpose and effect as the provision being varied.

Please call me at 604-233-4071 if you have any questions concerning the variance process or Warren Fulton, Certifications Officer, Certification Services at 604-619-5415 if you have any questions concerning the content of the variance.

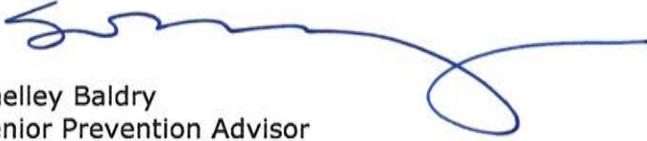
The *Workers Compensation Act* section 96.3(3) allows a person affected by this decision to request a formal review of the decision. Affected persons may include an employer, worker, owner, supplier or union. To exercise this right, a written request will need to be submitted to the Review Division within 45 days.

**NOTE:** The Review Division can be contacted at 604-214-5411 or toll free at 1-888-922-8804. Information is also available on the WorkSafeBC website at [http://www.worksafebc.com/claims/review\\_and\\_appeals/default.asp](http://www.worksafebc.com/claims/review_and_appeals/default.asp).

The Employers' Advisors office of the Ministry of Jobs, Tourism and Skills Training and Responsible for Labour is available to provide advice or assistance to employers. Their telephone number is 604-713-0303, or toll free at 1-800-925-2233.

The Workers' Advisors office of the Ministry of Jobs, Tourism and Skills Training and Responsible for Labour is available to provide advice or assistance to workers. Their telephone number is 604-713-0360, or toll free at 1-800-663-4261.

Yours truly,



Shelley Baldry  
Senior Prevention Advisor  
Regulatory Practices  
Worker and Employer Services  
WorkSafeBC

Copies to: Gordon Chudleigh, Employer Co-Chair, Ministry of Transportation and Infrastructure  
Alex Crawford, Workers' Co-Chair, Ministry of Transportation and Infrastructure  
Brandon Thistle, BCGEU Health & Safety Officer, BCGEU  
Warren Fulton, Certification Officer, Certification Services, WES  
Chris Elliott, Certification Officer, Certification Services, WES  
Patrick Davie, Manager Prevention Field Services, Kamloops, WES  
Mark Harper, Occupational Safety Officer, Prevention Field Services, Kamloops, WES  
Firm File: Ministry of Transportation and Infrastructure – 4000-175

Enclosure(s)

## TERMS OF VARIANCE – VR201600107

<b>Regulation</b>	<p>A variance is granted to the requirement in section 21.56(2) of the <i>Occupational Health and Safety Regulation</i> that states:</p> <p><b>21.56 Safety fuse assemblies</b></p> <p>...</p> <p>(2) Safety fuse assemblies less than 1 m (3.3 ft) in length must not be used.</p> <p>Granting this variance to the section(s) listed above does not relieve the employer of a duty to ensure compliance with all other sections of the <i>Occupational Health and Safety Regulation</i> and the <i>Workers' Compensation Act</i>.</p>
<b>Date granted</b>	November 3, 2016
<b>Responsibility</b>	The variance is granted to the employer, Ministry of Transportation and Infrastructure, Firm No. 4000-175, who has responsibility to ensure that these terms are complied with.
<b>Jobsite/ work process</b>	The variance is only applicable to the use of an Avalanche Guard or Wyssen Tower at Mt. Fortitude, 3 Valley Gap, and Summit Lake. If the location of the worksite changes or if the variance granted to one jobsite is to be applied to another jobsite, the employer must apply for another variance.
<b>Special terms</b>	<p>The conditions and procedures set out in your letter of August 23, 2016, which is attached, must be complied with, as well as the following:</p> <ol style="list-style-type: none"><li>1. The Blaster of Record must hold a valid Avalanche Control blasting certificate.</li><li>2. The Blaster of Record must exercise continuous visual supervision over any assistants who may be involved with preparation, loading and firing of these devices.</li><li>3. Safety fuse assemblies must not be trimmed until just prior to assembling the charges.</li><li>4. Unused trimmed safety fuse assemblies must destroyed as per manufacturer's instructions.</li><li>5. The initiation of the Avalanche Guard or Wyssen Tower must be from a remote location by the Blaster of Record (who must hold a valid Avalanche Control blasting certificate).</li><li>6. In the event of a failure to detonate, the manufacturer's misfire procedures will apply and must be followed.</li><li>7. In the event of a miss fire being in the avalanche snow pack a minimum of a 30 minute wait must be observed after all snow has stopped moving before permitting anyone to enter the danger area.</li></ol>

## TERMS OF VARIANCE – VR201600107

- Posting** A copy of these terms, along with any documents to which they refer, must be maintained at the worksite and be available for inspection by WorkSafeBC officers. The same documents must be posted on a suitable bulletin board in legible condition for the period of the variance. If affected workers will not receive notice by posting on a bulletin board, then the variance must be otherwise made known to all affected workers.
- Joint committee** A copy of these terms, along with any documents to which they refer, must be given to the Joint Occupational Health and Safety Committee or to the Worker Health and Safety Representative, as applicable.
- Time limited** This variance will be valid in conjunction with the Ministry of Transportation and Infrastructure's accepted 2016 Avalanche Control Blasting Procedures, and will expire on July 31, 2021.
- Verification** The worksite may be inspected by WorkSafeBC officers to confirm these terms are being met.
- Failure to comply** If the terms and conditions of this variance order are not met, the order is without effect and the applicable sections of the *Occupational Health and Safety Regulation* apply. Any non-compliance with the terms and conditions of this variance order, or other infractions relating to the subject matter of the variance, may also result in imposition of orders and administrative penalties.
- Validity** The granting of this variance is based on the completeness and accuracy of the information provided to WorkSafeBC. Any failure to have provided complete and accurate information may result in revocation of the variance and imposition of orders and administrative penalties.
- Reconsider** WorkSafeBC may reconsider the granting of the variance, or its terms, if it is later found to have been granted in error, new information is received since it was granted or the applicable *Occupational Health and Safety Regulation* provisions are substantively amended.
- Re-application** Application for another variance upon the expiry of this variance must be made to the Senior Prevention Advisor, Regulatory Practices.
- Future variance applications can be expedited if the firm's application includes letters from the union and the relevant Joint Occupational Health and Safety Committee or Worker Health and Safety Representative setting out their position in relation to the application.

  
Shelley Baldry  
Senior Prevention Advisor  
Regulatory Practices  
Worker and Employer Services  
WorkSafeBC

### **III. APPENDICES**

APPENDIX C – WSBC EXPLOSIVE AVALANCHE CONTROL PROCEDURES  
ACCEPTANCE FOR FIRM # 4000 -175

July 26, 2021

John Buffery  
MOTI, AWP  
310 Ward St, 4<sup>th</sup> Floor  
Nelson, BC V1L 5S4

Dear John Buffery:

**RE: Explosive Avalanche Control Procedures for Firm No. 4000-175**

Thank you for submitting your Explosive Avalanche Control Procedures, dated June 7, 2021. These procedures have been reviewed and accepted by WorkSafeBC under Section 21.85(1) of the Occupational Health and Safety Regulation ("OHSR"). This acceptance is subject to the following conditions:

1. This acceptance is in effect until July 31, 2026.
2. You are authorized to conduct the following control measures:
  - Helicopter Deployment
  - Hand Charging
  - Cornice Control
  - Case Charging
  - Avalanche Guard
  - Wyssen Tower
3. Before operations take place, the blaster of record must ensure that they have considered the entire scope of the danger area that may result from the blast. The blaster of record must ensure that guarding of the danger area is in accordance with the OHSR s. 21.66. The information contained in the Avalanche Atlas and the Avalanche Safety Plan for the specific avalanche area must be considered prior to designating the danger area and guarding of the area for the duration of the blasting operation. Furthermore, for industrial settings, the blaster is to ensure consideration is taken regarding protecting structures and equipment, which may be exposed to the effects of the blast.
4. Emergency procedures, including a rescue and evacuation response plan, must be in place for all avalanche control work. All workers must have adequate and appropriate rescue equipment available for use.

5. All explosive materials must be stored, handled, and used in the manner recommended by the manufacturer and required by the OHSR. All applicable manufacturers' information must be available on site for reference and training by all blasters/workers involved in your control program.
6. This acceptance is conditional on the employer acquiring the appropriate authorizations and having satisfied the requirements of all other applicable regulatory agencies including, but not limited to, Transport Canada, British Columbia Safety Authority, and Natural Resources Canada. The granting of this acceptance does not constitute a finding by WorkSafeBC that those requirements have been met.
7. All misfires must be effectively guarded, and the zone affected closed until such time as the misfire is located and disposed of. Due to the possibility of movement of misfired explosives by natural or planned avalanches, persons must be educated to identify explosive products, what the potential hazards associated with a misfire are, and who to contact if an explosive product is found. Location of found misfires must be communicated in a timely fashion to the blaster of record.
8. If misfires are suspected in an avalanche debris deposit, and machinery is required to clear the debris, a blaster of record must be on site. The blaster of record is to maintain a minimum number of workers required to clear the debris and must be in direct control and supervision for all work. Any misfires located or suspected will be handled as required by the OHSR.
9. Transport of primed charges by vehicles is strictly for case charging operations and is restricted solely to the specific safe area assigned to the blast site. Primed charges must be secured and effectively separated from all other explosives and must not be stored in the passenger compartment of any vehicle. Whenever possible primed charges should be transported separately from other explosives.
10. The granting of this acceptance does not constitute a finding by WorkSafeBC that the employer's procedures or equipment used for belay, or anchoring for belaying, when conducting cornice or avalanche control meet the requirements for Part 34 of the OHSR regarding Rope Access.
11. Section 21.85(4) of the OHSR requires that your procedures be reviewed annually and that any proposed changes be submitted to WorkSafeBC for approval prior to implementation. WorkSafeBC's acceptance of your procedures does not relieve the employer (and the contractor) from its obligation to ensure worker health and safety in accordance with Section 115 of the *Workers' Compensation Act* ("Act") or any other obligation under the Act or OHSR.

WorkSafeBC accepts no liability for any loss or damage caused by the employer's avalanche control activities, including, but not limited to, the employers use of or failure to use these work procedures. (This information can be found on our website at [www.worksafebc.com](http://www.worksafebc.com).)

12. Please keep a copy of this letter available with the procedures for inspection by a WorkSafeBC officer.

You may be asked to re-submit your procedures, regardless of changes, at any time. WorkSafeBC may, at its discretion, review and reconsider this acceptance at any time. Reasons that might cause a review of your procedures include but are not limited to:

- a) WorkSafeBC's receipt of new information or the determination that there has been an error relating to this acceptance and;
- b) Changes to the OHSR, OHS Policies, OHS Guidelines, or other laws affecting occupational blasting or avalanche control best practices.

If you have any questions on the content of this letter, please contact Certification Services at 604-276-3090, toll-free at 1-888-621-7233, or via email at [Certification@WorkSafeBC.com](mailto:Certification@WorkSafeBC.com).

Yours truly,



Angélique Prince  
Manager, Certification Services  
Prevention Programs & Performance

AP/vs

Copies to: Warren Fulton, Certification Officer, Certification Services  
Sonja Kristinsson, Certification Officer, Certification Services  
Mark Harper, Occupational Safety Officer, Prevention Field Services – Kamloops  
Firm Avalanche Control Procedures File  
Employer File WSE Ministry of Transportation and Infrastructure – 4000-175