

ADELAIDE UNIVERSITY GLIDING CLUB INC.

WINCH DRIVING MANUAL



Revision	Date	Comment
1st Issue	September 2000	AUGC
2nd Issue	December 2006	SAA winch operation
3 rd Issue	April 2009	Periodic update

This manual is available on-line at
<http://www.augc.aus-soaring.on.net/manuals.html>

ABOUT THIS MANUAL

This manual provides guidelines for winch operations at the Stonefield Airfield.

This document is issued by the Joint Instructors Panel of the Adelaide University Gliding Club Inc. and the Barossa Valley Gliding Club Inc

Queries should be directed to the CFI at CFI@augc.on.net

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1. WINCH OPERATIONS POLICIES

- “Winch Launching” (GFA) is focused on glider winch launching and not winch driving, but is reproduced here in part.
- Only GFA members shall act as winch drivers (to ensure coverage by the GFA BBL insurance)
- The winch crew shall include a Level 1 or 2 winch driver
- It is recommended that the winch crew include two people (i.e. a winch driver and another). This is to provide immediate help if an injury occurs
- People on the airfield shall be briefed about the dangers of winch operations
- Only TOST rings shall be used on traces
- A suitable weak link shall be installed in-line between the main cable and the trace with the load rating specified in the gliders manual and/or placard
- It is recommended that safety glasses be worn by the winch crew during the launch
- The winch truck/tow vehicle shall not be driven recklessly (i.e. at excessive speed). The winch truck shall be driven with care near people, gliders or vehicles
- The winch shall not launch gliders when there is a thunderstorms risk
- The runway shall not be less than 1200m long for winch operations
- Fire fighting equipment shall be available when there is a bush/grass fire risk

2. SAFETY

A first aid kit shall be available at the launch point and/or on the winch. It is recommended that the kit be periodically checked and replenished.

A fire extinguisher shall be present on the winch. It is recommended that a fire fighting trailer should be present wherever there is a bush/grass fire risk. Winch and launch crews shall be able to operate the equipment. If possible the equipment should be tested and/or refilled/recharged before flying operations.

It is recommended that radios be used for communication between the winch and the launch crews. It is recommended that one-way communication methods not be relied on, in order to avoid miscommunications.

The hazardous area near the tie down points shall be fenced off by a line of witches' hats and rails. The winch crew shall ensure that people are safe and clear of the tie down area before laying cables. All people shall stay clear of cables. It is recommended that cables only be approached or crossed after ensuring there is no risk (i.e. a launch is not in progress or the winch is not laying cables). Cables shall only be disconnected from the tie downs by the launch crew with communication from the winch that it is stopped or ready.

Winch launching presents the risk of bodily injury and the winch crew or people near the winch shall be safe before proceeding with a winch launch. Safe locations include: inside the winch cab, inside a car or winch truck/tow vehicle cab or well clear of danger (i.e. on the opposite side to the drum in use and behind and distant from the winch). It is recommended that safety glasses should be worn during launches by any person inside the winch cab. People are protected in the winch cab by sheet metal, safety glass or polycarbonate sheeting.

People shall keep clear of moving parts on the winch (i.e. engine, drums, cable) to avoid the risk of serious injury. Work on or near the drum and cable areas shall only proceed if the winch engine is off and the launch crew have been instructed, and confirmed, not to pull the cables.

People shall operate with the assumption that the cable may be reeled in at any time. As a result crews shall handle the cable accordingly (i.e. never insert fingers in the Tost rings). It is recommended that crews should wear gloves when handling cable and never run a hand along the cable, owing to the ability of sharp cable ends or frays to cause cuts.

3. TRAINING / QUALIFICATIONS

Winch drivers shall have a formal log book endorsement or authorisation sticker, shown in Appendix D. This authorisation recognizes that winch drivers have received training and proven their competency. The Duty Instructor shall act as final authority on permitting winch drivers to operate the winch on a daily basis.

Winch driver ratings include:

- Level 1 – may operate the winch without supervision
- Level 2 – may operate the winch and train winch drivers.

It is recommended that trainee winch drivers should be solo pilots or sufficiently trained pilots with good familiarity with glider winch launching.

Trainee winch drivers shall be familiar with this manual. It is recommended that the Training Book Part 1 (White) should be used to record winch driver training progress. The Duty Instructor/Instructors Panel/CFI should be informed about new trainee winch drivers.

The trainee winch driver shall be issued with a Level 1 rating and authorization sticker when they are considered competent to operate the winch without supervision.

It is recommended that the Level 1 winch driver should be issued with a Level 2 rating when they have demonstrated a higher degree of competency, after acquiring experience. The Level 2 rating shall only be issued by a Level 2 or 3 Instructor.

It is recommended that winch drivers should maintain currency.

4. DAILY INSPECTION

The winches require a daily inspection before flying operations.

Item to Check	Requirement
Fire extinguisher	Filled/charged and serviceable
First aid kit	Readily accessible/equipped
Truck cab/tow vehicle cab	Clean
Weak links, swages and cable repair tools (i.e. swage crimping tool)	Sufficient, serviceable and readily accessible
Cable cutters	Present and serviceable
Traces	Correctly made and damage free – Refer Appendix A
TOST rings	Inspect for cracks, wear or distortion
Witches hats	Sufficient and serviceable
Radios	Available, charged, aerial fitted, set to correct channel and tested
Window panels	Clean
Tires	Inflated and serviceable
Battery	Terminals clean and securely attached
Battery isolator	Not isolated
Fuel	Sufficient for the day's operation
Engine coolant	Check fluid level
Engine oil	Check fluid level
Transmission fluid	Check fluid level
Truck/tow vehicle brake fluid	Check fluid level
Drag/drum brake fluid	Check fluid level
Drag/Drum brake	Test effectiveness
Pulleys/Heads	Check for free bearing movement
Truck/tow vehicle engines	Start and warm up, which may require the choke

The fuel bunker should be checked and other consumables and a low level (i.e. less than ¼ full fuel bunker) should be reported to the treasurer (treasurer@augc.on.net) and people flying on subsequent days. These actions ensure that fuel and other consumables may be ordered promptly, and that operating necessities can be guaranteed for subsequent days. Ensuring a fuel supply may require coordination for the return, exchange and filling of fuel cans.

The cables shall be inspected (i.e 'walked') periodically (i.e. monthly or when excessive cable breaks are occurring), which is best done well before flying operations commence. It is recommended that cable sections in poor condition be removed. Cable in poor condition includes damaged cable, frays in stranded cable, worn swages or excessive repairs in a short length of the cable. Solid cable repairs should be periodically removed and replaced.

The cable length shall be monitored as the cables may require additional cable when the cable is only just greater than the runway length.

Fire fighting equipment, such as the fire fighting trailer, shall be inspected, filled, charged and tested as required daily. Crews should be trained to use this equipment, which is best done before flying operations.

5. DRIVING THE WINCH TRUCK/TOW VEHICLE

The winch truck/tow vehicle shall only be driven on public roads if registered and roadworthy. It is not necessary that winch drivers to have a drivers licence when driving on the airfield.

Radios (CB) may be operated by the public, without a licence. The channel selected shall not be an emergency channel or conflict other local radio traffic.

The winch truck/tow vehicle shall not be driven at excessive speed or in a reckless manner. The winch shall be driven with care near obstacles, including people, gliders or vehicles. When approaching the launch point or near obstacles the winch truck shall slow to walking pace. It is recommended that the winch truck reverse to the tie down area, with care, if necessary to avoid obstacles.

The winch truck/tow vehicle shall not drive on or across a runway without checking that it is clear from flying traffic. The winch driver shall always maintain a look-out for air traffic, and give way to a landing aircraft (i.e. see and avoid). It is recommended that the winch be stopped or driven off the runway if a collision risk exists.

It is recommended that care be taken when reversing the winch truck/tow vehicle, due to the large overhang and poor visibility to the rear.

6. LAYING CABLES – WINCH CREW DUTIES

Before laying cables:

- a tie down point weak link comprising a single strand of cable (from stranded cable) shall be used to secure the cable ends to the tie down pegs
- the drum brake shall be engaged and the cables shall be drawn taut to prevent cable overruns
- the drum selector shall be in neutral
- people shall be clear of drums, cables and tie down points
- the mirrors shall be adjusted to readily see each drum
- the radio volume shall be audible from winch truck/tow vehicle cab
- maintain a look-out to ensure that the runway approach is clear

While laying the cable the winch truck/tow vehicle driver (or a second winch crew who can sit in the winch cab set) shall:

- operate the drag brakes
- ensure that all people are clear of the winch before laying cables and relay this to the winch truck/tow vehicle driver
- maintain a look-out to ensure that the circuit is clear (and relay aircraft movements to the winch truck/tow vehicle driver)
- monitor the radio (and relay this to the winch truck/tow vehicle driver)
- monitor the cables and drums while laying cables, watching for tangles/cable breaks (relay problems to the winch truck/tow vehicle driver and apply drum brakes as necessary)
- monitor the remaining cable length to ensure that the winch truck/tow vehicle stops before the cable end is reached. If the winch is driven too far the cable will pull tight, break the tie-down weak link and cause delays at the launch point

During the laying of the cables the winch truck/tow vehicle driver shall:

- lay cables along the runway
- accelerate the truck/tow vehicle gently and to less than 40 km/hour

- avoid following the runway tracks runway and ruts
- not steer away from the edge of the runway in the first 200m and thereafter steer the winch progressively towards the centerline of the runway at the far end. If the winch is driven abruptly toward the centerline, the outer cable may cross over the centerline cable, which may cause a tangle. Also, during the first launch the glider may ground run across the second cable and may cause a main wheel or tailskid hook-up
- check for a crosswind and drive the winch to the upwind side of the runway to account for the likely drift on launch
- decelerate slowly, especially at the runway far end to avoid cable overruns. The drum/drag brakes should effectively brake the winch.

After laying the cables to the runway far end the winch crew shall:

- engage the appropriate gear (Park/1st Gear), the park brake and/or a wheel chock to immobilise the winch
- release the drum/drag brake, while using the foot brake to progressively release residual tension from the cable
- check the engine temperature. If the engine is cold (<80°C) warm it up in neutral and with the drum selector in neutral. If the engine is hot (>110°C) it is recommended that the engine be allowed to cool down prior to the next launch, check the thermostatic fan is running and check the winch engine water level
- select the appropriate drum, being the centerline cable (relative to the runway launch end) initially and the outer cable lastly
- inform the launch point that “the winch is stopped” by radio.

If only one cable is required, then lay either cable.

If a paddock retrieve is conducted, lay only one cable. As a tie-down point is not available a risk is present with a second ‘lose’ cable.

7. LAUNCH SIGNALS

The launch crew can communicate launch signals to the winch crew by several methods, listed in Table 1. These GFA endorsed methods are defined in the MOSP – Part 2. They are, in order of preference, radio, wing signals and headlamp signals. In addition, bat signals may be used but are not detailed here. Communication between the glider and the winch is prohibited.

TABLE 1 – Launch Signals

	Radio/ Telephone	Wing Signals	Headlamp Signals
Take up Slack	“<Aircraft Type> on line, Take up Slack, Take up Slack, Take up Slack”	Rock wings	Slow Flashing
All Out	“All Out, All Out, All Out”	Hold Wings Level	Fast Flashing
Stop	“ STOP, STOP, STOP”	Wing down	Continuous On

The launch shall not proceed if there is uncertainty about communications. All communication shall be only acted on if clear and unambiguous.

It is recommended that the launch crew communicate a “30 second warning” to the winch driver by radio call prior to a launch.

It is recommended that if radio is not possible then headlamp signals may be used. This would require a two person launch crew and car. It is recommended that if neither is available then wing signals may be used.

The launch crew may communicate additional information (i.e. water ballast/ simulated break).

8. PRE-LAUNCH

Prior to each launch the winch driver shall:

- ensure the engine is off in order to prevent damage to the half shaft splines inside the axle when selecting a drum
- select the appropriate drum, being the centerline cable (relative to the runway launch end) initially and the outer cable lastly
- check the engine temperature, and warm up or cool down as required
- check the engine idle condition. A rough engine idle may indicate the wrong manual choke position.
- check all people and vehicles are safe before commencing the winch launch

- inform the launch point that “the winch is ready” by radio.

9. LAUNCH – GROUND RUN, SEPARATION, INITIAL CLIMB AND FULL CLIMB

During the launching the winch driver shall:

- start the winch when the launch crew communicate a “30 second warning” or, at the latest, a “take up slack” signal
- act only when radio launch signals are repeated three times
- wait for a “take up slack” signal
- observe the gliders wings are level. **UNDER NO CIRCUMSTANCES** should the winch driver reel in the cable unless clear communications that are consistent with GFA conventions (Table 1)
- select the appropriate gear to start reeling in the cable and pull the cable tight. It is recommended that the brake and/or throttle be applied to slow the cable (i.e. walking pace or slower) or overcome any rolling resistance from the glider (i.e. cable stopped)
- wait for an “all out” signal
- progressively open the throttle to accelerate the glider so that additional power is applied until the glider is established in full climb. It is recommended that the glider be accelerated relatively rapidly as a glider with airspeed has many options. Slow glider acceleration results in a slow, low and shallow climb that may cause the glider to enter the non-maneuvering area, where its options after a cable break are limited. The throttle setting reached may depend on the type of aircraft being launched, whether it has water ballast, and the head wind component. A 90° cross wind has no head wind component so the throttle setting will be approximately that for a still day
- prepare for a “stop” signal
- account for wind shear, where the glider climbs into an increasing headwind that adds to its indicated airspeed, so that a reduce throttle setting may be required as the launch progresses
- ignore engine noise as engine rpm and launch speed are not always related owing to changing wind conditions and glider differences
- observe the cable sag, as an way to control the launch speed. It is expected that the ideal launch would feature a constant cable tension

throughout the launch. This may allow the glider to climb optimally. The bow or sag in a cable suspended between two points is related by many factors, however it is found to be approximately proportional to the tension in the cable. However, on strong wind days more sag will be present in the cable than on calm days, which is due to the additional wind drag on the cable. The entire cable must be airborne for this method to be effective.

10. LAUNCH – SPEED SIGNALS

The winch driver shall watch the glider for signals or a launch emergency throughout the launch.

Too Fast	The glider yaws left and right
Too Slow	The glider lowers the nose and rolls left and right.

The winch driver shall respond accordingly with smoothly changes in power until the glider stops signaling.

It is recommended that the winch driver pays care with trainee pilot launches, as signals may be ambiguous.

11. TOP OF LAUNCH

The winch driver shall steadily reduce power as the glider approaches the top of launch (however the cable tension will remain constant). Failure to reduce power will cause a “too fast” signal in the latter launch stages.

The glider pilot may end the launch by lowering the nose and releasing the cable. The winch driver shall maintain power to ensure the drogue chute inflates and cable tension is maintained.

The winch driver may end the launch by closing the throttle smoothly (i.e. backing the power off) so that the glider pilot will be compelled to lower the nose to maintain airspeed and release the cable before the glider flies over the winch.

The glider release should automatically release the cable, due to the back release mechanism. The winch driver shall monitor the end of the launch for the possibility of a hook-up (recommended hook-up responses can be found below).

The winch driver shall terminate the launch sufficiently early when launching with a tail wind, to ensure the cable does not become tangled over the winch.

12. RELEASE / REEL IN

The winches may be fitted with drogue chutes, which keep tension in the cable during reel in and while airborne. A drogue chute shall not be fitted where wind may cause the cable end to be a risk (i.e. tangling in power lines).

If a drogue chute is not fitted and stranded cable is used the winch driver shall:

- initially reel the cable in slow enough to let winch arms fall to the horizontal position. If this does not occur (i.e. due to a jam) then the reel in shall stop. The cable will rapidly fall to the ground. The winch crew shall lower the winch arm by hand when safe. This is preferred to reeling the cable in with a sharp turn through the winch head
- apply power to maintain cable tension and pack the cable tightly on the drum
- observe where the trace lands
- monitor the trace to identify movement indicating that practically all cable has been wound in
- reduce power, select neutral and apply the drum brakes to ensure the trace are not drawn through the heads. It is recommended that the winch driver reduce power to idle and select neutral sufficiently early so that brakes may not be required and the traces are not drawn through the heads

If a drogue chute is fitted and stranded cable is used the winch driver shall:

- initially apply sufficient power to deploy the drogue chute and prevent the cable from touching the ground
- monitor the falling drogue chute and reduce power to nil if it lands, to prevent damage to the drogue chute from bushes, etc. The remaining cable shall subsequently be reeled in at a slow pace and reduce power, select neutral and apply the drum brakes to ensure the trace are not drawn through the heads.

If a drogue chute is fitted and solid cable is used the winch driver shall:

- initially apply sufficient power to deploy the drogue chute and prevent the cable from touching the ground
- monitor the falling drogue chute and apply sufficient power to ensure the cable will be fully reeled in with the drogue airborne
- reduce power to nil, select neutral and apply the drum brakes to ensure the trace are not drawn through the heads

It is recommended that the winch driver should check the effectiveness of the drum brakes before they are needed.

The winch driver shall monitor the cable drums to check for a cable tangle. If a tangle occurs the winch driver shall stop the winch and untangle the cables.

13. POST LAUNCH

If another cable is available the winch crew shall:

- turn off the winch engine
- select the other cable drum
- communicate a “winch is ready” radio signal to the launch crew
- disconnect the trace at the winch link sister clips
- stow the drogue chute and trace

If no other cable is available the winch crew shall:

- turn off the winch engine
- select the neutral cable drum position
- engage the drag brakes
- disconnect the trace at the winch link sister clips
- stow the drogue chutes and traces
- ensure the drums will not unwind
- ensure all tools and cable off-cuts are collected and stowed
- drive to the launch point, as per Section 6

14. GROUND RUN – OVER RUNS

The glider may overrun the cable on launch during the ground run and the cable may be released by the pilot or back release. As the glider stops close to the launch point, either the glider is pushed or towed back to the launch point or is launched as is.

If the glider is far from the launch point the glider may be towed/pushed back to the launch point. This may require additional cable to be reeled-out from the winch, which may be dragged by people or towed by car. Alternatively the winch may reeled-in the cable. The winch crew shall communicate with the launch to ensure people are clear before acting, as the winch crew may be disentangling the cable or the glider may not be clear of the cable.

It is recommended that a car be used to tow out significant additional cable. It is recommended that the cable be attached to the tow ball of the car using the tie down weak link. The winch crew shall apply the drag brakes. The launch crew shall communicate with the launch to ensure people and gliders are clear of the cable before acting. The tow car shall drive at walking pace.

15. LAUNCH – CABLE BREAKS

The winch driver shall:

- be prepared for a cable break at any time during the winch launch
- keeping a foot on or near the brake pedal
- keeping a hand on or near the gear lever

Instructors will simulate cable breaks during training and check flights and:

- on stranded wire winches the instructor shall pull the cable release
- on solid wire winches the instructor shall ask the winch driver to cut power at a specified height

The winch driver shall respond to a cable break and consider whether:

- the glider may land immediately
- the glider may join a modified circuit

If the glider may land immediately the winch driver shall:

- cut power immediately
- select neutral
- stop the cable with the foot brake
- monitor the trace and note where it lands

If the glider joins a modified circuit the winch driver shall:

- reel-in the cable

If the cable end lands over the other cable, the launch crew shall retrieve the cable end, as the cable represents a danger to continuing operations. The cable end shall be retrieved by a car, attached to the tow ball by a weak link. The trace shall be disconnected at the sister clips to prevent damage during the tow. The winch crew can retrieve and repair the cable end without assistance for the last cable.

16. LAUNCH – HOOK UPS

If a hook up of the glider and the cable occurs (i.e. due to failure of the release, jamming of the back release, or entangling of the cable with the glider) the winch driver shall take prompt action to:

- stop the engine
- select neutral gear
- notify the launch crew
- notify the glider pilot
- cut the cable, only if it is safe to do so

It is recommended that the glider may make descending turns near to and overhead the winch. The glider shall descend until required to land, which will be near the winch but clear of obstacles the cable may catch on.

It is recommended that the winch crew stay in the cab, to keep safe from falling cable. To cut the cable safely the winch crew shall:

- ensure the cable cutters are at hand
- ensure they are safe from falling cable
- cut the cable through access doors

17. LAUNCH – POWER LINES

If operations occur near power lines then in the event of a cable break the winch crew shall:

- monitor the cable to check if the cable falls across the power lines
- remain on the winch until the cable lands
- cover eyes to avoid flash damage at the moment of contact
- avoid contact with remnant cable hanging from the power lines
- notify the launch crew

Experience demonstrates that stranded cable may explosively disintegrate when shorting from the power line to earth.

Experience demonstrates that grass/scrub fires may result. The winch and launch crew shall contact the CFS and shall use the fire trailer as required.

A report to the power company shall be made promptly.

18. LAUNCH – OTHER CONTINGENCIES

If the winch engine stalls or is not running properly the winch driver shall abort the launch. The winch driver shall ensure that the winch engine is adequately warm (i.e. water temp of 80°C), the choke is closed and the engine is running smoothly prior to launch.

If the winch truck/tow vehicle is not braked, the winch may roll during the launch, especially under full throttle. If the winch is rolling during the launch the winch driver shall abort the launch.

In the event of a fire, the winch driver shall abort the launch. A fire extinguisher (water) is provided on the winch to extinguishing minor fires (not oil fires). A fire trailer is provided to fight larger fires.

If the winch driver is in any doubt about safety the winch driver shall abort the launch.

19. EFFICIENT WINCH OPERATIONS

It is recommended that efficient winch operations can occur if:

- all people work as an organised team – 2 person each launch and winch crew
- the winch crew shall:
 - make a “winch is stopped” radio call as the winch halts at the runway far end
 - release the brake
 - engage the appropriate drum
 - start the engine
 - make a “winch is ready” radio call
- the launch crew shall:
 - monitor the progress of the winch to act as soon as the winch is stopped
 - releases the cable and hooks a glider on
 - make a “30 seconds” radio call
 - conduct the launch
- the winch driver shall:
 - conduct the first launch
 - select the second drum
 - make a “winch is ready” radio call
 - conduct the second launch
 - select the drum neutral position
 - apply the drag brake
- the second winch crew shall:
 - disconnect and stow the first cable trace as soon as the reel-in is complete, but only if there is sufficient time to do so before the second launch occurs.
 - disconnect and stow both cable traces as soon as the second reel-in is complete
 - drive the winch to the launch point
- at the launch point:
 - the winch driver shall ensure release/engage drum brakes as necessary for the launch crew
 - the launch crew shall attach the cable to the tie downs

- the launch crew/winch driver shall promptly notify the winch truck/tow vehicle driver that it is safe to lay new cables

Efficient winch rely on good communications between the winch crew and the launch point crew including:

- reliable radio communications
- a winch crew that keeps the launch crew informed of winch status.
- a launch crew that keeps the winch crew informed about launches

20. ADDING NEW CABLE TO THE DRUMS

It is recommended that new cable be added to the drums when the cable end is not much greater than the runway length.

Replacement of the entire cable is unnecessary as the cable does not wear evenly along its length.

Cable joins shall follow instructions shown in Appendix A.

Additional cable shall be added to cable at the glider end, where greatest wear occurs.

A full spool of new cable is heavy and shall be mounted on a robust spindle during the task.

The cable wrap on the new cable and the spool shall be matched. Stranded cable may tangle more easily if wound with the incorrect wrap.

Tension shall be applied to the new cable that requires a drag brake to be applied to the spool during transfer. A drag brake could be a tire or a piece of heavy timber held across the spool by two people.

The new cable may sit compactly on the drum. Avoid overloading the drum with cable.

21. END OF OPERATIONS

The winch crew shall complete all end of day tasks, without assuming that operations will occur on the next day.

The winch crew shall reel-in unused cables. The launch crew shall disconnect the weak link and trace and attach a tire (to provide drag and tension the cable) Ensure that the cables are unhooked from their tie downs.

The launch crew shall ensure that missing traces are searched for at the end of the day.

Item to Check	Requirement
Launch point	Collect witches hats, etc
Cable off-cuts and rubbish (in cab)	Discard cable off-cuts and other rubbish appropriately.
Handheld radios	Return/recharge radios in clubhouse
Parking winches	Park the winch Clear the cabin(s) of all items Carry personal items to clubhouse Close windows and vents
Battery	Isolate battery
Winch arms	Stow arms (i.e. looping traces around arms and through the winch cage)
Winch consumables.	Take stock of consumables (cable, swages, weak links, etc) and fuel Inform others so that consumables can be ordered/arranged to permit operations to continue on subsequent days
General Condition	Ensure the winch is safe/ secure.

The launch and winch crew shall report any damage or concerns to the Duty Instructor.

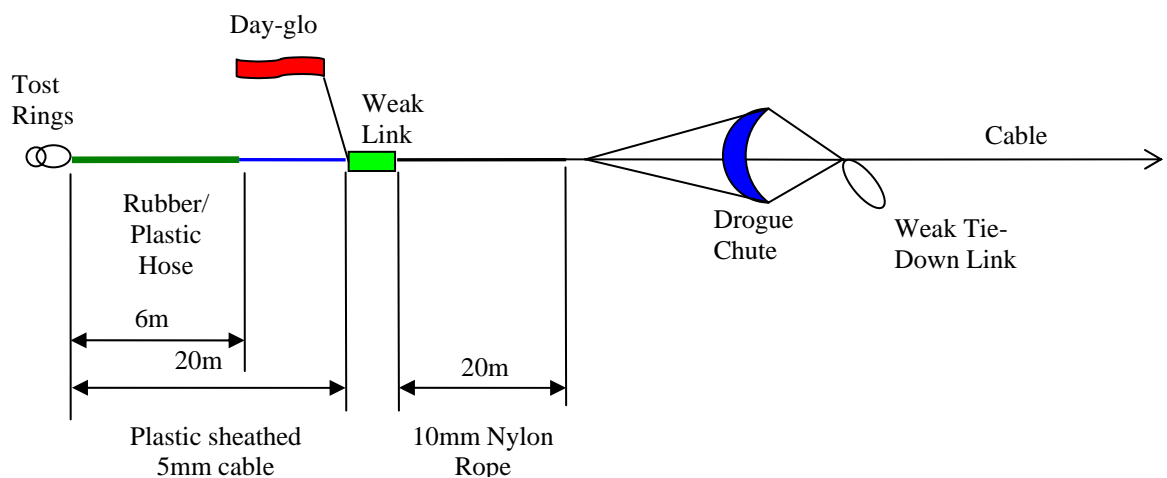
APPENDIX A STANDARD TRACE, CABLE AND JOIN ARRANGEMENT

TRACES WITH DROGUE

The traces shall include:

- Tost rings
- 20m of plastic coated 5mm trace cable, with the 5m nearest the rings sheathed in rubber/plastic hose. The hose provides some stiffness to the cable and reduces the chance of a hook-up. It is recommended that a swage joint between included in to limit movement of the hose.
- Day-glo, if available, in order to improve trace visibility on the ground
- a weak link of the appropriate rating attached by Sister clips in order to allow quick exchange of weak links
- 10-20m of 10mm Nylon rope in order to act as a shock absorber
- a drogue chute. It is recommended that the drogue chute be attached using U-shackles
- Sister clips in order to allow quick release of the trace from the cable
- a swivel in order for the drogue chute to freely rotate
- a weak link (a single strand from the 5mm cable) at the end of the cable in order to attach the cable to the tie down points

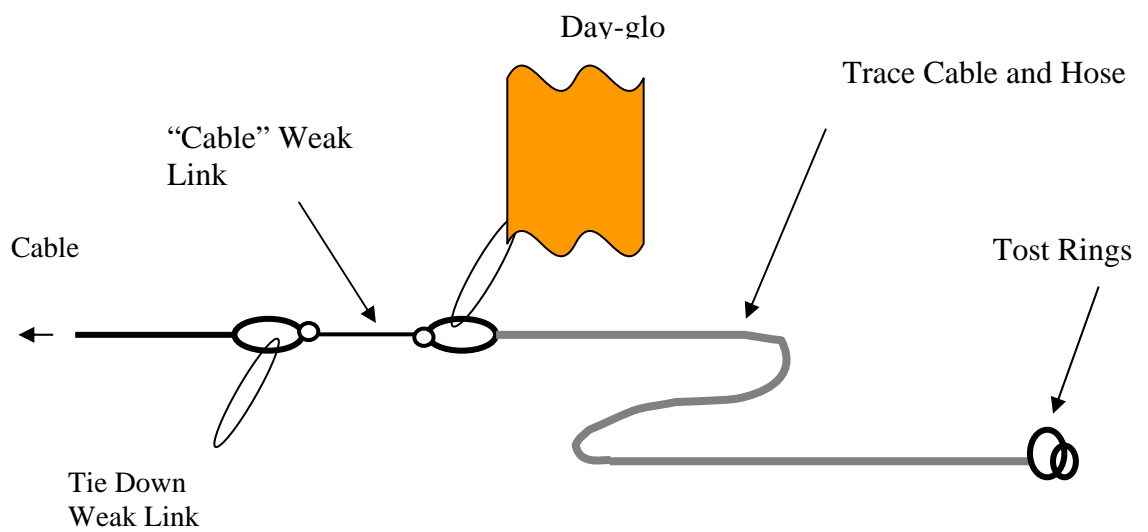
Diagram of trace arrangement:



TRACES WITHOUT DROGUE

The traces shall include:

- Tost rings
- no less than 5m trace cable sheathed in rubber/plastic hose. The hose provides some stiffness to the cable and reduces the chance of a hook-up
- Day-glo, if available, in order to improve trace visibility on the ground
- a "cable" weak link
- a weak link (a single strand from the 5mm cable) at the end of the cable in order to attach the cable to the tie down points



TOST RINGS

Only TOST rings shall be used. The trace shall be attached to the LARGE ring, as shown below.



The alternative OTFUR ring is not approved for use and if identified by having a large round ring, compared with the elongated large TOST ring. It is recommended that OTFUR rings only be used on ground handling towropes.

SISTER CLIPS

Sister clips are used to allow quick release of the drogue chute, weak link and trace, as shown below. Sister clips allow ready exchange of Tost weak links of differing breaking strengths. Disconnection shall be made by aligning the gap on each clip and sliding the pair apart.



STRANDED CABLE JOINS USING SWAGES/FERRULES

Stranded cable shall be joined using no less than two aluminium ferrules, as shown in the figure below. 5mm of cable shall protrude beyond the swages and the swages shall be 50mm apart.

Excessively worn joins shall be replaced.

Short sections of cable with many joins shall be removed.

It is recommended that copper swages not be used, however if compelled to, copper swages shall be used on the winch end of the join and an aluminium swage on the glider end of the join.

Swages in stranded cable and knots in solid wire are easy to inspect. In both cases, if there is any doubt as to their integrity, cut them out and remake them. It is time-consuming, but well worth it in terms of safety and convenience.



Stranded cable (wire rope) - standard swage

SOLID CABLE JOINS

Solid cable shall be joined by a reef knot, as shown in the figure below. It is recommended that 300mm tails are required to tie the knot. The cable tails shall be tightly wound around the cable a minimum of three times so that the join may pass easily through the winch heads. The remaining tails shall be cut off. The knot will pull tight, as shown below, after several launches.,



APPENDIX B WEAK LINKS

A suitable weak link shall be installed in-line between the main cable and the trace with the load rating specified in the gliders manual and/or placard.

Aircraft	Winch Release Weak Link	Tost Weak Link Colour
Blanik L13	650kg	Grey
Bergfalke IV	500kg	White
Puchatek	660 kg	Orange
Arrow	450 kg	White
Club Libelle	510 kg	White
Standard Libelle	500 kg	White
Pik 20B, D	500 kg	White
Boomerang	450 kg	White
Astir		White
DG200	500 kg	White
Ventus	500 kg	White

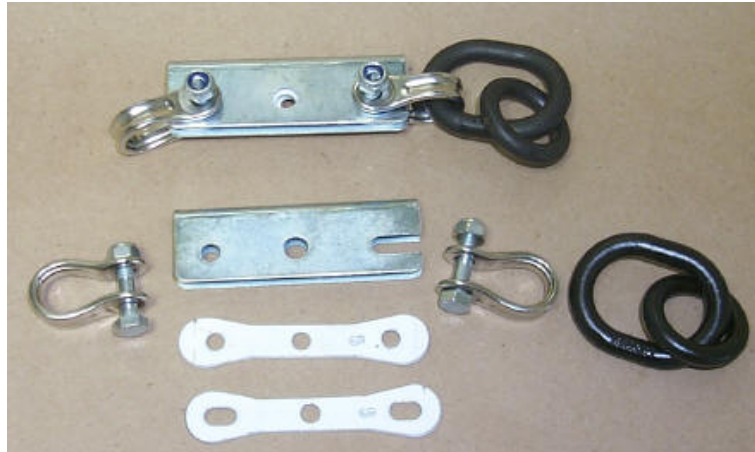
Tost Weak Link Colour	Weak Link Limit
White	500 kg
Blue	600 kg
Orange	645 kg
Red	750 kg

TOST WINK LINKS

Tost weak link includes a sheath and interchangeable blades, shown below, shall only be used with drogue chutes.

The Tost weak link sleeve shall be aligned with the open, or slotted, end facing the glider, in order that the sleeve will be retained by the cable end (and not the trace end) making loss with the trace less likely.





CABLE WINK LINKS

The cable weak link shall include 150mm section of 3mm galvanized steel cable (7x7) with a loop swaged (2 of) each end. It is recommended that weak links be replaced by joined to the cable and trace with reef knots, as shown below.



APPENDIX C CABLE, SWAGES, ETC SPECIFICATIONS AND SUPPLIERS

Main Cable:	5mm galvanized steel cable 7x7 (Approx. 1000m rolls)
Main Cable Swages:	5mm aluminium machine press ferrules (low cost) 5mm aluminium hand press ferrules (high cost)
Trace Cable:	5mm galvanized steel cable 7x7 with plastic sheath
Weak Link Cable:	3mm 7x7 galvanized cable
Weak Link Cable:	3mm aluminium machine press ferrules
Cable/Ferrules/Tools:	BHP Lifting Products Bullivants (www.bullivants.com) Grand Junction Rd (CNR South Rd) Wingfield 5013 Ph: 8260-4711 / Fax: 8260-5610 Noble A & Son Ltd. (www.nobles.com.au) 80-92 Grand Junction Rd Kilburn 5084 Ph: 8260-6688 / Fax 8260-6260 Glasscraft Marine Pty. Ltd 247 Pirie St Adelaide 5000 Ph: 8223-3055 / Fax: 8223-7517
Sister Clips	Glasscraft Marine Pty. Ltd 247 Pirie St Adelaide 5000 Ph: 8223-3055 / Fax: 8223-7517
Trace Hose:	Rubber hydraulic hose Nylon water hose Fitch the Rubber Man 2 George St Hindmarsh 5007 (08) 8346 5193
Day-Glo:	Simonson M Australia 140 Days Rd Ferryden Park 8347 0099
TOST rings/Weak links	GFA Sales

APPENDIX D

LOGBOOK AUTHORISATION STICKERS

<p style="text-align: center;">Adelaide University Gliding Club Inc.</p> <p style="text-align: center;">WINCH DRIVER AUTHORISATION - LEVEL 1</p> <p>This is to certify that</p> <hr/> <p>is authorised to operate the winch in accordance with the AUGC Winch Driving Manual.</p> <p style="text-align: center;"><i>Level 1 Winch drivers are not authorised to train other winch drivers.</i></p> <p>Issued by (AUGC Level 2 Winch Driver)</p> <p>_____ Date _____</p> <p style="text-align: center;"><i>CFI to be advised when new authorisations are issued.</i></p>

<p style="text-align: center;">Adelaide University Gliding Club Inc.</p> <p style="text-align: center;">WINCH DRIVER AUTHORISATION - LEVEL 2</p> <p>This is to certify that</p> <hr/> <p>is authorised to operate the winch in accordance with the AUGC Winch Driving Manual; to train new winch drivers in the safe and efficient operation of the winch and to issue Level 1 Winch Driver authorisations accordingly.</p> <p>Issued by Instructor (Level 2 minimum)</p> <p>_____ Date _____</p> <p style="text-align: center;"><i>CFI to be advised when new authorisations are issued.</i></p>
