

Ski Club of SA: PORTALIFTS 1 & 2 DOCUMENTATION, PART I of 5
FEATURES, OPERATING PRINCIPLES AND POINTERS FOR PORTABLE LIFTS
No's 1 AND 2 v 2011-05-02 Chris Inskip

(For overview of Parts I to V, see last page)

NOTA BENE

- Unlike fixed lifts, a portable consists, for the sake of portability, of a number of separate items which have to be unpacked, moved and assembled, also, after use dismantled, moved back to storage site and packed away. It is easy for piece(s) to get lost, so that the outfit becomes unusable.

- Inappropriate treatment or use or storage can result in damage to components.

In such cases, later would-be users can find the outfit unserviceable, when it is needed.

Fortunately, the story is 90% the same for both lifts. Referring to illustrations Part V:

Basic features

The V-groove pulley on the engine / drive unit drives the endless liftrope around the V-groove- and return pulleys - Fig 1.

The drive unit can deliver up to a certain uphill "pull" into the liftrope, at the V-groove. Given the engine and the gearing (built-in gearbox, V-belt, and/or chain) between the engine and the V-groove pulley, this maximum pull, at the engines' max-power speed of 3600 rpm, is:

in lift No 1, about 110kg, with liftrope speed about 3.3m/s

in lift No 2, about 210kg, with liftrope speed about 2.2m/s.¹

In order for the V-groove pulley to transfer this pull into the liftrope, there needs to be:

- i) a tension of not less than 10kg in the liftrope slack side (Fig 1) and
- ii) a sufficient wrap-around of the liftrope around the V-groove pulley.

The value i) has been set at this low level, 10kg, for both lifts, because it will be necessary to anchor the return pulley with a strength of 2 x (max slack side tension), and this anchorage will generally need to be in the snow, where it is not easy to get a strong anchorage. When value i) is thus kept down to 10kg, the requisite anchorage strength is kept down to around 2 x 10kg = 20kg; see further below: "Preventing slipping ..." and "Anchorages".

Given this value i) = 10kg, the requisite value ii) is:

¹ These pull values suffice to pull a number of people depending on steepness of the slope. These liftrope speeds were chosen to be manageable for beginners and tots. Later information was that 2.2m/s is good, 3.3m/s perhaps a bit high (but lift No 1 has to my knowledge not evoked complaints).

in lift No 1, half a turn, 180°
in lift No 2, 3/4 of a turn, 270°.

On lift No 1 the 1/2 turn is easily attained (#1 Fig 2), but on lift No 2 there is a jockey (Fig 1b, #2 Fig 2) to hold the liftrope in the V-groove for the requisite additional 1/4 turn.

Safety

For safety, both drive units are arranged so that the liftrope can easily slip sideways off the V-groove pulley if a piece of clothing or a hand is carried in by the liftrope. In addition, on lift No 2, the jockey (Fig 1b) can lift up to allow the rope and clothing or hand to fall completely away, or pass thro.

When the liftrope comes off the V-groove pulley, it would i) shoot off downhill and ii) come off the return- /idler pulleys (Figs 1, 3b). Therefore for i) there is a catch loop (#1 Fig 2, Fig 1b, #2 Fig 2) to keep the end close to the drive unit, so it can easily be picked up and replaced in the V-groove, and for ii) there are shrouds over these pulleys.

Design avoids clips / attachments of any kind on the liftrope. They would be a hazard; could e.g. catch in users' clothing, or fail to fall off the liftrope and get stuck in pulleys. Instead, the use of thickish rope (see "Liftropes and reels") allows users to get enough grip with work gloves (elegant ski gloves will get shredded).

Preventing slipping; provision to deal with stretching of the liftrope

The liftrope stretches significantly when it comes under load, i.e. when people hitch on at the bottom. This would cause loss of slack-side tension at the V-groove pulley, hence slipping; the coil spring and anchor peg are provided to prevent this. They are set up (via the tensioning assembly, Fig 1) to exert initially 25kg pull on the return pulley, causing slack-side tension 12.5kg. When people hitch on, the stretch of the liftrope allows the spring to contract somewhat and therefore exert reduced pull. The spring is designed still to exert 20kg pull on the return pulley when the spring has contracted 0.5m from the 25kg stretch, hence maintain requisite 10kg slack-side tension at the V-groove pulley.

This 0.5m is a bit of a guess; it is a question whether it will suffice if e.g. the lift #2 is used with full 300m length and enough people hitch on to cause the engine's speed governor to open the throttle and deliver the full +/-210kg pull into the rope. If it doesn't suffice, and slipping occurs at the V-groove pulley, it may cure the problem to limit the load, i.e. the number of people riding at once.

Such slipping must be stopped quickly because it will chew up the liftrope.

In order to facilitate setup so that the spring tension is 25kg, a length of blue/white rope is placed inside the spring as a guage.

This setting should be checked at intervals during use to ensure that the tension remains at or close to 25kg, with no-one riding (because there may be some stretch in the liftrope during use).

Anchorage

The anchorage strength required for the coil spring is, from the foregoing, 25kg. My understanding is that one or more pegs set in the snow have generally sufficed.

Anchorage at the drive-unit prevents the unit from being pulled downhill. Anchorage should ideally pull somewhat downward on the drive unit to prevent its being lifted off the surface by the liftrope, when a rider gets close to the top. Anchorage strength required = (available uphill pull + twice slack-side tension 10kg), i.e.,

in lift No 1, about 130kg

in lift No 2, about 230kg.

The anchorage point (karabiner or e.g. a link of chain) allows a simple single-point anchoring, and is carefully positioned on the drive unit so as to prevent back-and-forward pitching etc of the unit as load fluctuates.

Up till now, we've always found a rock to serve as anchorage. If not, try the larger anchor peg in some fashion, or a deadman.

Liftropes and reels

Ropes: Design intention is to allow for lift-run lengths of ca. 100m, 200m or 300m. For this, lengths of rope of approx 200m and approx 400m are provided. Rope used is 10mm diameter polypropylene 3-strand/hawser lay, for easy grip, easy splicing, durability, limited extension under load, light weight and low price. This has come in 10kg rolls each around 220m length. So a 400m length was obtained by splicing together two 10kg rolls.

Each length has an eye spliced into each end. The eyes of a single length can be joined by say 3 loops of 2mm flat parachute cord, to give a single length made endless - Fig 4. Alternatively eyes of two lengths can be similarly joined to give a longer endless assembly (e.g. 300m - Fig 4).

The max load falling on the 3 loops of parachute cord = (available uphill pull + slack-side tension 10kg), i.e.,

in lift No 1, about 120kg

in lift No 2, about 220kg, i.e., with 3 loops, about 37kg per strand of cord.

The cord wears in passing over the V-groove pulley, so it occasionally breaks and has to be replaced.

The outfit includes spare cord for such repair or for rearranging liftrope assembly - Fig 4.

Reels: The reel design (illustration "REEL FOR LIFTROPE") aims to accommodate 20kg/ca. 400m of rope. IDEALLY we need a number of reels equal to the number of lengths we keep up on the mountain.

The reel has a V-belt mounted on one of its ends; it can thus be put onto a ski stick without basket and driven by the V-groove pulley on the drive unit to wind up the liftrope onto the reel when packing up. During setting up the lift, the reel can be held on the ski stick and the liftrope reeled off from it, onto the slope.

Assembly / dismantling of drive unit and provision for tensioning of belt gearing

In each drive unit there is:

- i) a V-belt drive as part of the transmission and gearing between the engine and the V-groove pulley
- ii) an assembly, including the V-groove pulley, which can be detached from the remainder- and main part of the drive unit. This detachability inter alia facilitates portage, transport and storage and is linked with provision for adjustment of belt tension in belt drive i).

See Figs 1a/b, "Portable lift No 1 Fig 2", and "Portable lift No 2 Fig 2" for detail.

Design change to No 2: See Fig 2: Effective Apr 2011, new parts Prop R and Rail S replaced original components in same position (supporting the anchorage end of tension bar P). Purpose is greater ease of assembly etc.

Provision for portage

An adapted rucksack frame is provided to help with moving the gear to/from site of use - photos Fig 3.

Other points

Fig 1 shows a pair of ski sticks pulling the slack side off to one side near the return pulley. This or other provision will perhaps be desirable to prevent the two sides of the liftrope from getting twisted together through rotation of the return pulley.

Fig 1 shows a pair of ski sticks forming a bipod, holding the return pulley up off the surface. This has in practice proved unnecessary; people manage to pick up the rope from the surface.

Before unpacking / setting up a lift, it is advised to ensure that manpower is committed also for subsequent packing up and storage. It shouldn't be left to a single individual. I think 3 people is about the minimum. I see 3 reasons why the outfit generally cannot be left out on the slope; it could get i) buried by snowfall (happened in Lesotho 1990) ii) damaged by sunshine etc iii) stolen, under present conditions.

USERS' MANUAL Part III should be studied for further points.

Overview of documents, incl. background info etc: (P(ortrait) or L(andscape))

- PART I of 5 FEATURES, OPERATING PRINCIPLES AND POINTERS FOR PORTABLE LIFTS No's 1 AND 2 (this file Plifts_1.doc) 5 pp P
- PART II of 5 Portable Lifts No 1 and No 2: Outline Users' Manual (Plifts_2.doc) 1 p L
- Pt III of 5 USERS' MANUAL (file Plifts_3.doc) (step-by-step instructions) 5 pp L
- PART IV of 5 PORTABLE SKI LIFTS No.1 with GS45 engine and No. 2 with GX240 engine: Periodic maintenance (file Plifts_4.xls) 1 p P
- PART V of 5 Portable lifts - Illustrations (file Plifts_5.doc) 10 pp L

In PART V, there are 10 pp:

Front / cover page incl. photo of slope below summit ridge **

Figs 1, 1a, 1b (3 pp)

"Portable lift No 1 Fig 2" **

"Portable lift No 2 Fig 2"

Fig 3 (photos) Engines on rucksack frames**

Fig 3b

Fig 4

REEL FOR LIFTROPE

** must be printed in colour

For everyday use refer to documents for using lift(s), i.e. specific, sequenced steps for setting up / using / dismantling / storing:

- PART III together with PART V

After some experience, you may perhaps manage with "quickstart" condensed version of users' manual, PART II, instead of PART III.

OTHER MATERIAL avble for records:

main arcdox02/gx240.doc Specs / data re engine