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滑雪用魔毯安全要求

Safety requirements for conveyor belts of skiing



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前 言

本文件按照GB/T 1.1—2020《标准化工作导则 第1部分：标准化文件的结构和起草规则》的规定起草。

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引 言

滑雪用魔毯是一种采用循环运行的输送带，将滑雪者从下站（上车区）输送到上站（下车区）的固定式驱动设备。伴随着国内滑雪运动的发展，魔毯在滑雪场所得到了广泛使用，已经成为滑雪场所至关重要的人员输送设备。

为进一步推动滑雪用魔毯技术的规范和发展，提高行业技术水平和运行安全性，保护乘用者的人身安全，减少故障和事故的发生，让魔毯成为滑雪场所的安全运载设备，特制定本文件。本文件提出了滑雪用魔毯的基本安全要求，旨在为国内滑雪用魔毯的设计、制造、安装、使用、检验和管理提供有效的技术依据。



滑雪用魔毯安全要求

1 范围

本文件规定了滑雪用魔毯的线路规划设计与计算、设施设备、安装、试验与检验、运营与维护、标志与标识。

本文件适用于采用多层结构连续胶带作为输送带的滑雪用魔毯的设计、制造、安装、检验、使用与维护。

本文件不适用于采用标准链板作为输送带的魔毯。

2 规范性引用文件

下列文件中的内容通过文中的规范性引用而构成本文件必不可少的条款。其中，注日期的引用文件，仅该日期对应的版本适用于本文件；不注日期的引用文件，其最新版本（包括所有的修改单）适用于本文件。

GB 2894	安全标志及其使用导则	
GB 50007	建筑地基基础设计规范	
GB 50009—2012	建筑结构荷载规范	
GB 50010	混凝土结构设计标准	
GB 50231	机械设备安装工程施工及验收通用规范	
DL/T 5161.5	电气装置安装工程 质量检验及评定规程	第5部分：电缆线路施工质量检验
DL/T 5161.6	电气装置安装工程 质量检验及评定规程	第6部分：接地装置施工质量检验
DL/T 5161.7	电气装置安装工程 质量检验及评定规程	第7部分：旋转电机施工质量检验
DL/T 5161.8	电气装置安装工程 质量检验及评定规程	第8部分：盘、柜及二次回路接线施工质量检验
DL/T 5161.12	电气装置安装工程 质量检验及评定规程	第12部分：低压电器施工质量检验

3 术语和定义

下列术语和定义适用于本文件。

3.1

魔毯 conveyor belts

通过动力驱动方式，利用移动输送带运送滑雪者，承载表面与运行方向保持平行，滑雪者在其上站（下车区）立运输的连续运输设备。

注：根据使用场所的不同，魔毯主要分为滑雪用雪地魔毯和非滑雪场娱乐用旱地魔毯。

3.2

上车板 loading plate

安装在魔毯下站（上车区）末端，同时作为迂回装置的盖板，辅助滑雪者踏上输送带的固定平板。

3.3

安全活动板 safety flap

安装在魔毯上站（下车区）输送带末端、驱动或迂回滚筒上方的活动平板。

注：魔毯处于正常状态时，安全活动板盖住输送带绕过滚筒的末端折返区域。当有异物卷入输送带和安全活动板之间时，可平移或旋转打开安全活动板，并使魔毯停机。

3.4

下车板 unloading plate

安装在魔毯上站（下车区）起始端、安全活动板之后，有向下坡度，引导滑雪者迅速离开上站（下车区）的固定平板。

3.5

名义速度 nominal speed

在额定频率和额定电压并且空载情况下，由制造商设计确定的，输送带沿运行方向的速度。

3.6**有效宽度 effective width**

输送带两侧的导向板之间的水平横向距离。

3.7**被授权人员 authorized person**

经魔毯运营单位的负责人授权，进入输送带上、魔毯内部或设备周围相邻区域进行维修、检查或救援操作的人员。

4 线路的规划设计与计算**4.1 线路的规划设计****4.1.1 线路选择**

4.1.1.1 魔毯不应建在有雪崩、滑坡、塌方、溶洞或7级以上大风频发等危及魔毯安全的地区。

4.1.1.2 魔毯线路中心线在水平面上的投影线应为一条直线。

4.1.1.3 魔毯的平面设计布局应使乘用魔毯的滑雪者在魔毯出现故障停机时，能在沿线任意位置安全离开魔毯。

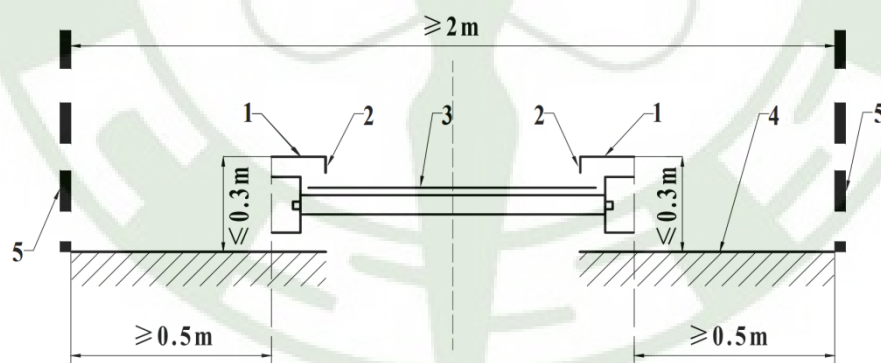
4.1.2 线路坡度

4.1.2.1 线路的最大坡度不应超过25%（14.04°）。

4.1.2.2 每条魔毯输送带的两个连续段之间的坡度差不应超过12.5%（7.13°），每段的坡度应恒定且长度不应小于1.5 m。

4.1.3 线路两侧和上方的自由净空

4.1.3.1 室外魔毯线路两侧的横向自由净空应不小于0.5 m，并且输送带平面以上总的横向净空应不小于2 m。除因安全运行需要安装的电气柜、急停开关、人流监控装置外，两侧自由净空内从雪面往上应无障碍物，并且雪面的高度不应超过输送带上表面的高度（如图1所示）。



标引序号说明：1——侧面盖板；2——侧面导向板；3——输送带；4——雪面；5——障碍物。

图1 魔毯周围净空示意图

4.1.3.2 线路两侧的自由净空内，雪面与魔毯侧面盖板上表面之间的高度不应超过0.3 m（如图1所示）。

4.1.3.3 除输送带侧面盖板和导向板以外，输送带上表面以上空间内应为自由空间。除因安全运行需要安装的电气柜、急停开关、人流监控装置外，上方自由空间内应无障碍物。上方装设顶棚时，顶棚与输送带之间在中心线位置的净空不应小于2.3 m。

4.1.3.4 如果电气柜、急停开关、人流监控装置需要安装在 4.1.3.1 和 4.1.3.3 规定的自由空间内，这些设施应有防护或采取了降低滑雪者受伤风险的措施。

4.1.4 与周围其它设施净空

4.1.4.1 魔毯与雪道之间应设置安全网或雪墙，防止滑雪者意外冲入魔毯线路。安全网或雪墙与魔毯之间的净空应符合 4.1.3.1 的要求。

4.1.4.2 两条并行的魔毯，相互之间的净空不应小于 1 m。

4.1.5 运行速度

4.1.5.1 输送带的名义速度不应大于 0.75 m/s。

4.1.5.2 应能以 0.4 m/s 或更低的速度运送儿童。

4.2 线路计算

4.2.1 基本要求

线路设计时，应至少对输送带载荷、魔毯启动和停车惯性力、输送带断裂强度、线路承重结构件强度进行计算校核。

4.2.2 输送带载荷

穿滑雪板、滑雪靴或携带滑雪装备的滑雪者在输送带上的自重，平均每人重力按 790 N 计算。最小连续均匀分布载荷按 1700 N/m² 计算。

4.2.3 惯性力

应计算线路满载运行工况下由输送带质量、人员质量以及输送带带动的转动部分质量引起的下列惯性力：

- a) 正常启动加速度为 0.2 m/s² 时的惯性力；
- b) 工作停车减速度为 0.05 m/s²~0.1 m/s² 时的惯性力；
- c) 紧急停车距离为 0.3 m 时的惯性力。

4.2.4 输送带断裂强度

4.2.4.1 输送带及其接头的抗拉安全系数即输送带的最小断裂拉力与输送带最大工作拉力之比，不应小于 5。

4.2.4.2 输送带的最大工作拉力 (F) 应按照公式 (1) 进行计算：

$$F = f_1 + f_2 + f_3 + f_4 + f_5 \dots \dots \dots (1)$$

式中：

- F ——输送带的最大工作拉力，单位为牛顿 (N)；
- f_1 ——输送带张紧装置的最大张力，单位为牛顿 (N)；
- f_2 ——输送带在线路上的阻力，包括托辊上的阻力和导向装置的阻力，单位为牛顿 (N)；
- f_3 ——由坡度引起的输送带重力分力和满载时滑雪者在输送带上自重的分力，单位为牛顿 (N)；
- f_4 ——输送带在驱动装置和迂回装置内有关设备的阻力，单位为牛顿 (N)；
- f_5 ——输送带满载启动时的惯性力，单位为牛顿 (N)。

4.2.5 线路承重结构件强度

4.2.5.1 输送带下部所有承载结构件的屈服强度安全系数不应小于 3.5。

4.2.5.2 承载结构件和土建基础结构设计时应计算下列各种载荷的影响。

- a) 输送带张紧装置的最大张力。
- b) 魔毯设备自重。
- c) 滑雪者自重。
- d) 输送带启动和制动时的惯性力。
- e) 风载荷：按 GB 50009—2012 中第 8 章和附录 E 进行计算。

- f) 雪载荷：按 GB 50009—2012 中第 7 章和附录 E 进行计算。
- g) 冰冻地区的魔毯下部承载结构件和防护隔离罩上的冰载荷。冰层平均厚度可按 25 mm 或当地气象部门提供的数据，容积质量按 600 kg/m³ 计算。
- h) 滑雪者乘用途中对托辊的冲击动载荷，动载荷沿运行方向作用于线路两侧机架上，其值按 1 个托辊上实际载荷的 25% 选取。

5 设施设备

5.1 基本要求

5.1.1 魔毯应设下站（上车区）和上站（下车区）。

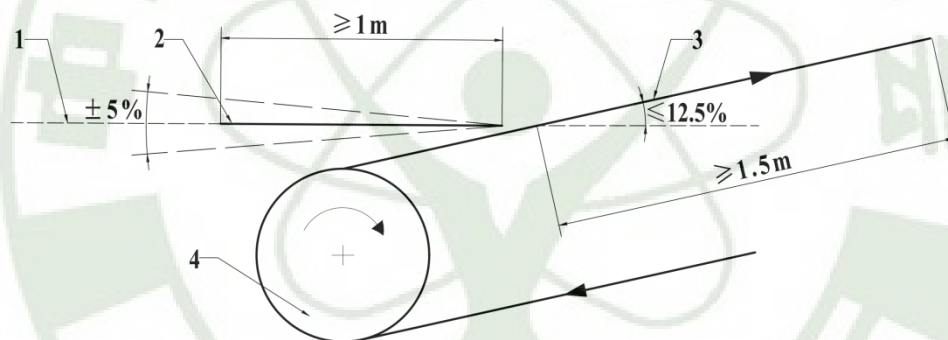
5.1.2 魔毯应至少由以下设备组成：

- a) 驱动装置和迂回装置；
- b) 清雪和加热融雪装置；
- c) 线路设施；
- d) 安全保护装置；
- e) 电气设备。

5.2 下站（上车区）和上站（下车区）

5.2.1 下站（上车区）

5.2.1.1 魔毯下站（上车区）末端应装设坡度恒定且长度不小于 1 m 的上车板。上车板坡度应在水平面的 $\pm 5\%$ ($\pm 2.86^\circ$) 范围内（如图 2 所示）。



标引序号说明：1——水平线；2——上车板；3——输送带；4——迂回滚筒。

图2 下站（上车区）示意图

5.2.1.2 上车板的任意一侧与地面或雪面的高差不应超过 0.3 m。

5.2.1.3 输送带上乘用起始点至少 1.5 m 的长度范围内，输送带的坡度应均匀，且与上车板间的坡度差不超过 12.5% (7.13°)（如图 2 所示）。

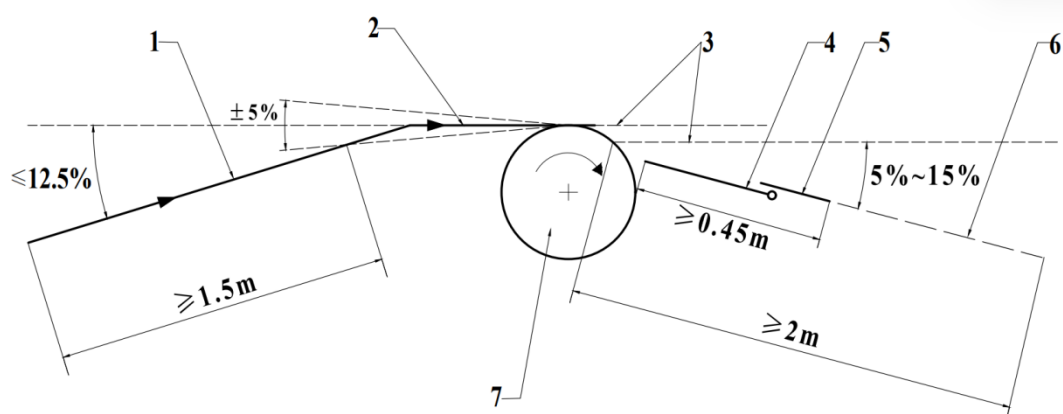
5.2.1.4 魔毯运行时，上车板与输送带表面之间的间隙宜为 6 mm，最大间隙不应超过 15 mm。

5.2.2 上站（下车区）

5.2.2.1 输送带靠近上站（下车区）的最末段的坡度应均匀，坡度宜在水平面的 $\pm 5\%$ ($\pm 2.86^\circ$) 范围内。（如图 3 所示）。

5.2.2.2 输送带倒数第二段在不少于 1.5 m 的长度范围内，坡度应均匀，与最末端输送带间的坡度差不宜超过 12.5% (7.13°)（如图 3 所示）。

5.2.2.3 输送带末端以外的上站（下车区）在至少 2 m 长度内应有一个 5%~15% ($2.86^\circ \sim 8.53^\circ$) 的反向坡度（如图 3 所示），并且此区域的入端应装设安全活动板和下车板，其横向宽度不应小于输送带的有效宽度。



标引序号说明：1——输送带（倒数第二段）；2——最末段输送带；3——水平线；4——安全活动板；
5——下车板；6——雪面；7——驱动滚筒。

图3 上站（下车区）示意图

5.2.2.4 安全活动板和下车板的总长度应不小于 0.45 m（如图 3 所示），下车板的任意一侧与地面或雪面的高差不应超过 0.3 m。

5.2.2.5 魔毯运行时，安全活动板与输送带表面、下车板与正常状态下的安全活动板的间隙不应超过 6 mm。

5.3 驱动装置和迂回装置

5.3.1 基本要求

5.3.1.1 驱动装置的传动轴、驱动滚筒的筒体、迂回滚筒的筒体应选用-20℃以下低温环境仍具有足够韧性及延伸率的材料。

5.3.1.2 驱动滚筒和迂回滚筒的筒体以及传动轴应进行屈服强度安全系数的校核，其屈服强度安全系数不应小于 3.5；传动轴应进行疲劳强度安全系数的校核，其疲劳强度安全系数不应小于 2.2。

5.3.2 驱动装置性能

5.3.2.1 驱动装置应能在满载工况下以最小为 0.1 m/s^2 的平均加速度启动。

5.3.2.2 驱动装置在运行中出现下列任何一种情况时，应能自动停车：

- 无电压或电压降低到特定最小值以下；
- 功率消耗上升到特定最大值以上；
- 任何一个安全保护装置被触发。

5.3.3 驱动滚筒和迂回滚筒

5.3.3.1 驱动滚筒表面应均匀覆盖带花纹的橡胶层或其他增大摩擦力的防滑材料。

5.3.3.2 上站（下车区）安装的驱动滚筒的直径不应小于 180 mm。

5.3.3.3 采用焊接工艺制造时，焊缝不应有裂纹和未焊透现象，并且应消除内应力。

5.3.4 动力传递部件

5.3.4.1 主驱动系统允许的动力传动方式为驱动滚筒与减速机直联、联轴器传动、齿轮传动，不应采用带传动、链条传动、摩擦轮传动。

5.3.4.2 动力传递装置中的联轴器、万向节等应按照满载工况进行计算。

5.3.5 制动器

5.3.5.1 制动力应由压缩弹簧产生并通过机械方式施加。

5.3.5.2 制动力应能均匀地分布在制动片上。

5.3.5.3 制动行程应留有余量，应能补偿制动片的磨损。

5.3.5.4 制动器的制动力矩不应小于满载工况下，即使制动片出现磨损、闸盘沾上油污或水汽、制动片和闸盘不均匀接触，也能使魔毯在 0.3 m 内制停所需的制动力矩。

5.3.6 张紧装置

5.3.6.1 液压张紧

5.3.6.1.1 应设置油压显示装置。

5.3.6.1.2 液压系统应有保压功能，保持系统压力的稳定。

5.3.6.1.3 液压管路和连接元件的破裂安全系数不应小于 3。

5.3.6.1.4 液压张紧装置应有低温防冻措施。

5.3.6.1.5 各种载荷工况下，输送带的伸长不应使油缸杆到达极限位置。

5.3.6.2 重锤张紧

5.3.6.2.1 重锤的结构设计应使重锤上下移动时不发生脱轨和卡阻现象。

5.3.6.2.2 重锤井应能防止雪、冰、水、杂物积存在重锤下面或周围，影响重锤移动。

5.3.6.2.3 应采用机械限位的方式限制重锤行程，在正常运行的情况下不应达到终端位置。

5.3.6.2.4 重锤与张紧装置采用钢丝绳连接时，钢丝绳应挠性好、耐弯曲，其抗拉安全系数不应小于 5.5。

5.3.7 输送带防跑偏装置

应在驱动装置处或迂回装置处设置输送带防跑偏装置，自动阻止输送带跑偏。

5.4 清雪和加热融雪装置

5.4.1 冰雪刮除器

5.4.1.1 驱动滚筒、导向滚筒、迂回滚筒表面应设有冰雪刮除器，防止表面结冰打滑。

5.4.1.2 冰雪刮除器与滚筒表面间隙应可调，其调节行程不宜小于 20 mm。

5.4.2 输送带自动清扫装置

5.4.2.1 魔毯应在上站（下车区）设置输送带的自动清扫装置，该装置应在输送带运行期间自动清扫输送带表面积雪或杂物。

5.4.2.2 清扫装置与滚筒表面间隙应可调，其调节行程不宜小于 20 mm。

5.4.3 加热融雪装置

5.4.3.1 加热融雪装置宜安装在自动清扫装置下方，该装置应能加热融化从输送带上扫落的积雪，并且融化后的水应能及时排出。

5.4.3.2 加热融雪装置的加热器应设置温度控制开关，导热介质采用液体时应设有液体不足报警的功能。

5.4.3.3 设有集水箱时，集水箱应有排水管，排水管应有低温防冻措施。

5.5 线路设施

5.5.1 输送带

5.5.1.1 输送带应选用耐-20℃以下低温环境并且耐磨损的材料。

5.5.1.2 输送带的附着力应能防止滑雪者在魔毯最大坡度处、冰雪化冻后潮湿的输送带上打滑。

5.5.1.3 单人输送带的有效宽度不应小于 0.4 m。

5.5.1.4 输送带横向应保持水平，横向坡度应在水平面的±1.5%（±0.86°）范围内。

5.5.1.5 输送带接头应选用抗腐蚀、并在-20℃以下工作环境温度仍具有足够的韧性和延伸率的材料。

5.5.1.6 输送带的接头连接件不应有大于 4 mm 的任何间隙。

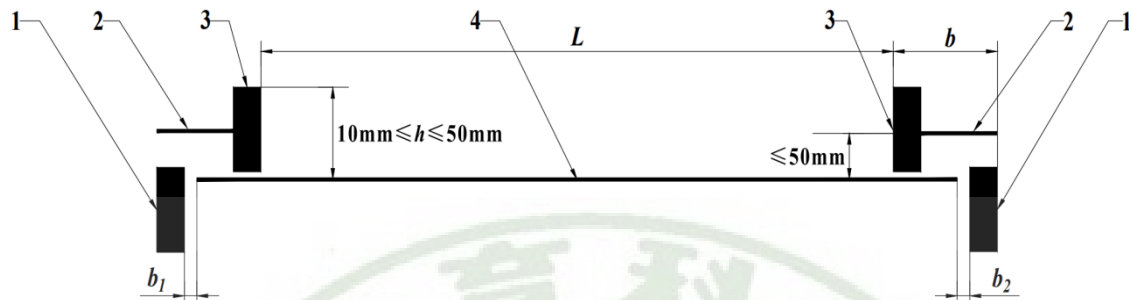
5.5.2 托辊

5.5.2.1 输送带在线路上宜采用托辊进行支撑。

- 5.5.2.2 托辊辊子应采用不锈钢材料。
 5.5.2.3 托辊两端应进行防水、防锈和密封设计，轴承应选用免维护型。
 5.5.2.4 托辊之间的最大间隙不应大于 40 mm。

5.5.3 输送带引导和滑雪者引导

5.5.3.1 输送带在整个长度范围内应设置侧面导轨，导轨应能阻止输送带跑偏（如图 4 所示）。



标引序号说明：1——输送带侧面导轨；2——盖板（也可用作雪板或鞋的导向板）；3——侧面导向板；
4——输送带。

图4 输送带及其附件示意图

- 5.5.3.2 应在输送带侧面上方安装导向板，其高度（ h ）为 10 mm~50 mm（如图 4 所示）。导向板应确保滑雪者穿戴的滑雪板或靴子在魔毯全线路均受到侧面连续光滑无障碍导向。
 5.5.3.3 导向板之间的水平横向距离（ L ）应不小于输送带的设计有效宽度（如图 4 所示）。
 5.5.3.4 魔毯运行时，导向板下沿与输送带上表面之间的间隙不应超过 6 mm。
 5.5.3.5 下部回程输送带的两侧面宜设置立式托辊导向装置，阻止输送带跑偏。
 5.5.3.6 回程输送带下部支撑托辊的间距应确保任何运行工况下以及启动和紧急停车时，输送带不因挠度过大而触碰底部支承结构和地面。

5.5.4 输送带侧面保护盖板

- 5.5.4.1 输送带的两边应装有保护盖板，盖板应将两侧的托辊端部和输送带边缘完全覆盖。盖板里侧面也可以用作导向板用，但应符合 5.5.3.2 的要求（如图 4 所示）。
 5.5.4.2 盖板的高度不应高出输送带上表面 50 mm 以上（如图 4 所示）。
 5.5.4.3 保护盖板在运行中应始终能压住输送带两侧边缘，即使在输送带跑偏的情况下也能防止其浮起。
 5.5.4.4 保护盖板的宽度（ b ）（如图 4 所示）应满足公式（2）的计算值：

$$b \geq b_1 + b_2 + 20 \quad \dots \dots \dots (2)$$

式中：

- b ——保护盖板的宽度，单位为毫米（mm）；
 b_1 ——输送带左侧间隙，单位为毫米（mm）；
 b_2 ——输送带右侧间隙，单位为毫米（mm）。

5.5.4.5 输送带侧面保护盖板以及导向板的设计应防止滑雪者衣物或身体部位被夹住、缠住或卷入，接缝应顺着魔毯的运行方向。

5.5.5 线路检修便道和机架侧面保护罩

- 5.5.5.1 线路输送带两侧机架上表面应方便工作人员检修时行走，表面应加装防滑覆盖物。
 5.5.5.2 线路机架侧面应设置防雪侵入输送带的隔离保护罩。

5.5.6 支承装置

5.5.6.1 材料

5.5.6.1.1 线路支承结构件应采用镇静钢，防止-20℃以下低温环境使用的脆断风险。

5.5.6.1.2 线路支承结构件材料宜选用耐腐蚀的镀锌钢材。

5.5.6.2 结构

5.5.6.2.1 线路支承结构的底部支腿应设有高低调节功能。

5.5.6.2.2 底部支腿的设计应计算在斜坡上魔毯设备的重力分力和热胀冷缩对上站（下车区）支承结构的受力影响，底部支腿应设计为安装后与水平面保持垂直。

5.5.6.2.3 魔毯的底部支承结构应使魔毯即使受到4.2.5.2所述各项载荷联合作用，也不应出现垮塌、倾覆、晃动、移位、连接松开。

5.5.7 线路基础

5.5.7.1 线路基础宜采用钢筋混凝土或预应力混凝土结构。

5.5.7.2 线路基础的设计应符合GB 50007、GB 50010的有关规定。

5.5.7.3 线路基础应能承受魔毯满载工况下由底部支承传递的负载。

5.5.7.4 线路基础的抗滑移、抗倾覆与抗扭转的安全系数不应小于1.5。

5.6 安全保护装置

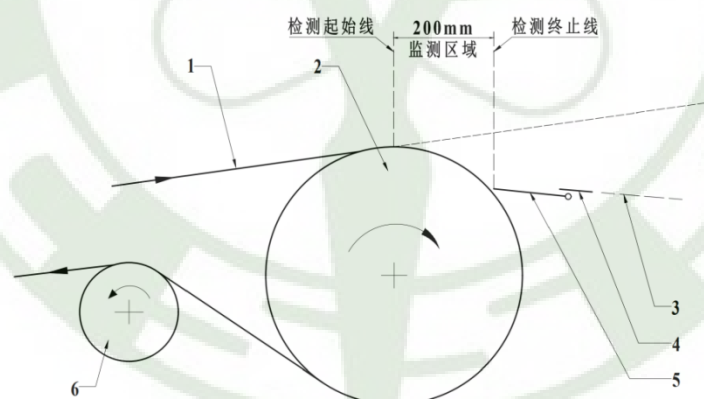
5.6.1 防护要求

5.6.1.1 除了输送带承载面外，其他所有运动部件都应加装防护隔离罩，阻止人员接近及触碰。

5.6.1.2 电气部件、检测开关、安全保护装置应有遮挡或进行防水、耐候性设计，安装位置应方便进行监测和维护，在-20℃以下低温、下大雪、空气潮湿或雨水溅射等恶劣天气下，其各自的检测、信号传输、运转和保护功能应完好有效。

5.6.2 上站（下车区）防跌倒监控装置

5.6.2.1 上站（下车区）输送带末端应设防跌倒监控装置，该装置应能检测到距离安全活动板最前端200mm以内的直径为100mm的球形物体（如图5所示）。



标引序号说明：1——输送带；2——驱动滚筒；3——雪面；4——下车板；5——安全活动板；6——导向滚筒。

图5 防跌倒监控装置检测区域示意图

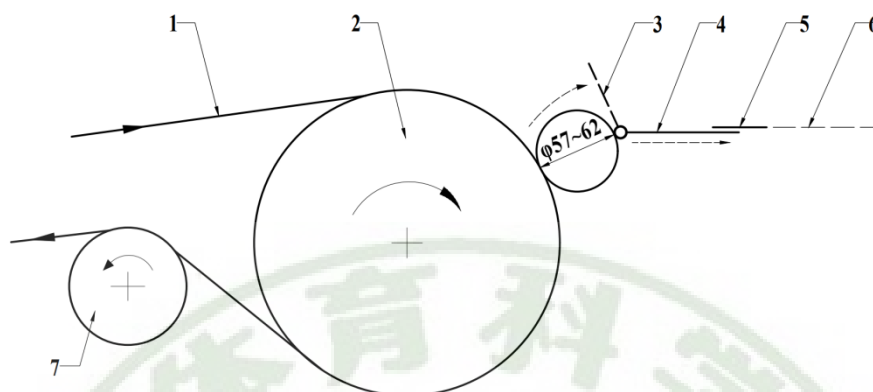
5.6.2.2 当滑雪者在安全活动板前的监测区域内静态停留时间超过3s时，应触发紧急停车。对于运行速度不超过0.4m/s的魔毯，停留时间可延长到5s。

5.6.2.3 如果使用光学检测装置，不应受灯光、阳光、雾天等环境变化的影响。

5.6.3 上站（下车区）防卷入监控装置

5.6.3.1 上站（下车区）输送带末端应设防卷入监控装置，当发生滑雪者衣物或肢体被卷入输送带和安全活动板之间，致使安全活动板位置移动或翻转时，应能立即触发紧急停车，最迟应在安全活动板与输送带之间的间隙达到 20 mm 时触发紧急停车。

5.6.3.2 安全活动板宜采用平移或旋转的方式打开，打开宽度应能达到 60 mm，完全打开时，该开口应允许直径不小于 57 mm 但不超过 62 mm 的球体通过（如图 6 所示）。

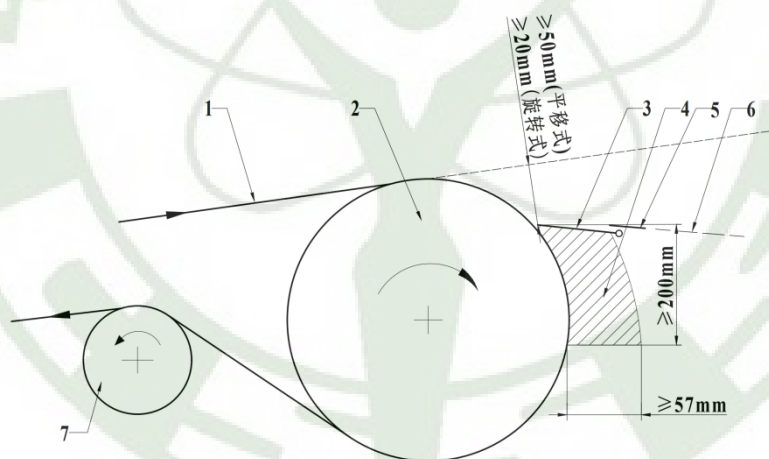


标引序号说明：1——输送带；2——驱动滚筒；3——安全活动板（翻板）；4——安全活动板（平移板）；
5——下车板；6——雪面；7——导向滚筒。

图6 安全活动板最大开口示意图

5.6.3.3 安全活动板边缘应呈圆角和倒角状，打开安全活动板所需的力应不大于 50 N。

5.6.3.4 平移式安全活动板应安装在魔毯输送带上表面延长线以下至少 50 mm 处，旋转式安全活动板应安装在魔毯输送带上表面延长线以下至少 20 mm 处（如图 7 所示）。



标引序号说明：1——输送带；2——驱动滚筒；3——安全活动板；4——自由空间；5——下车板；6——雪面；
7——导向滚筒。

图7 安全活动板安装位置示意图

5.6.3.5 在安全活动板之下至少 200 mm 深度的空间里，应允许直径 57 mm 的球体在紧贴输送带时通过（如图 7 所示）。

5.6.4 输送带打滑、逆转监控装置

5.6.4.1 魔毯应设置输送带打滑、逆转监控装置，该装置应能够监控输送带的运行速度和运行方向，防止输送带在驱动滚筒上打滑、运行中和停车后任何的逆转。

5.6.4.2 驱动装置的设计应能防止输送带在驱动辊筒上打滑。在任何工况下，驱动装置和张紧装置应提供足够的驱动力和张紧力，防止输送带的打滑和任何失控逆转。

5.6.4.3 当监控到输送带的速度低于驱动电机或驱动滚筒的速度差值超过限定值时，应触发工作停车。

5.6.4.4 当监控到输送带出现逆转时，应触发紧急停车，机械防逆转装置或制动器立即自动投入工作。

5.6.5 检修盖板监控保护

5.6.5.1 驱动装置和迂回装置的隔离防护区域应设置检修盖板，检修盖板应进行监控保护，当打开检修盖板时，驱动装置应不能启动或立即停止运行。

5.6.5.2 维修时，检修盖板应只能通过工具或钥匙打开。

5.6.6 多条连续且无中间出口的停止保护

多条连续且无中间出口或中间出口被建筑出口（例如闸门、防火门）阻挡的魔毯，其中的任意一条停止运行时其后部下方的魔毯应同时停止，其前部上方的魔毯不受影响。

5.7 电气设备

5.7.1 基本要求

5.7.1.1 电气设备的设计和选用

电气设备的设计和选用应符合 GB/T 5226.1 的有关规定。

5.7.1.2 工作（正常）停车开关

工作（正常）停车开关应设置在主控制箱和辅助控制箱的控制面板上，按下后触发工作（正常）停车，停车后，只能从工作停车触发的操作位置重启魔毯。

5.7.1.3 紧急停车开关

5.7.1.3.1 紧急停车开关应选用红色蘑菇头手动复位式。

5.7.1.3.2 在上站（下车区）、下站（上车区）以及线路长度超过 200 m 的线路中间应安装紧急停车开关。

5.7.1.3.3 紧急停车开关应有醒目的标志，在该装置上或紧邻位置处应标注“急停”字样。

5.7.1.3.4 紧急停车开关应有防止滑雪者滥用或误碰的措施。

5.7.1.4 主开关

5.7.1.4.1 在驱动装置或主控制箱上的控制面板上应有主开关。主开关应能断开电机、制动器释放装置和控制回路的电源。

5.7.1.4.2 主开关应具备设备检修锁定功能，魔毯停机不对外运营的维修期间，主开关应能通过钥匙等手段锁定在“断开”位置。

5.7.1.5 辅助设备开关

当辅助设备（如加热装置、照明装置）分别单独供电时，应能单独切断。各辅助设备开关应操作方便且应有明显标志。

5.7.1.6 控制箱

5.7.1.6.1 主控制箱

5.7.1.6.1.1 主控制箱应安装在上站（下车区）操作人员的位置。在该位置，操作人员应能观察到魔毯全线，尤其应能看到安全活动板上直径为 100 mm 的球体。

5.7.1.6.1.2 主控制箱上的控制面板应至少具有下列操作和信号指示功能：

- a) 启动和停止装置；
- b) 复位按钮；
- c) 速度控制器；
- d) 运行参数显示；

e) 故障显示。

5.7.1.6.1.3 主控制面板应有防护隔离，防止滑雪者触碰操作。

5.7.1.6.1.4 主控制箱应进行防雨设计，防护等级应达到 IP54。

5.7.1.6.1.5 主控制箱应设有自动恒温加热功能，应将箱内温度保持在 5℃ 以上。

5.7.1.6.2 辅助控制箱

5.7.1.6.2.1 车区操作位置以外的位置可安装其他辅助控制箱，但主控制箱与其他辅助控制箱不应同时有效，不应从两个控制位置同时启动魔毯，控制权宜设计为从主控制箱内进行选择。

5.7.1.6.2.2 辅助控制箱安装的位置应使工作人员能够观察到魔毯全线，特别是应能看到上站（下车区）安全活动板区域的滑雪者状况。辅助控制箱上控制面板的所有功能应纳入整体运行程序。

5.7.2 控制系统

5.7.2.1 基本要求

5.7.2.1.1 电气系统应设过压、过流、缺相等常规电路保护。

5.7.2.1.2 控制系统应能记忆故障，即使故障已排除、安全装置已复位，在人工按下复位按钮前该故障信号不应自动清除。

5.7.2.2 安全回路

所有停车装置和安全保护装置应组成连锁闭合安全回路，任一装置发出信号都应立即中断闭合回路后停机。

5.7.2.3 启动与停车控制

5.7.2.3.1 运行指令应在所有涉及安全启动的条件都具备时才能生效。

5.7.2.3.2 启动运行的指令发出 30 s 后魔毯没有运行时，该指令信号应自动撤销。

5.7.2.3.3 启动时应有电铃声或醒目红色警示闪烁灯提示。

5.7.2.3.4 停止功能应否定有关的启动功能，控制站为一个以上时，来自任何控制站的停止指令应有效。

5.7.2.3.5 任何停车故障的复位应在有效控制面板上手动复位。

5.7.2.3.6 主控制箱或辅助控制箱发起的紧急停车或设备故障停车应有报警声音，声音持续到手动复位后方可消除。

5.7.2.3.7 工作（正常）停车应平稳。在满载工况下，停机后魔毯不应溜车。

5.7.2.3.8 工作（正常）停车宜首先通过电气制动停车，在输送带降到零速时，制动器应释放其全部制动力。

5.7.2.3.9 紧急停车被触发后制动器应立即动作，输送带应在 0.3 m 内停止，并且在停止后，即使在满载的负载条件下应保持静止，不出现反向溜车。

5.7.2.3.10 在工作停车过程中，不应影响启动紧急停车控制，任何时候紧急停车应优先于工作停车。

5.7.2.3.11 魔毯突然停电或者电机的供电中断无法进行电气制动时，制动器应立即自动动作，并且在任何负载情况下不出现反向溜车。

5.7.2.4 安全电压

电控系统安全回路的电源电压应小于交流 25 V 或直流 60 V。

5.7.2.5 速度控制

运行速度不应受载荷变化影响，运行时运行速度的变化不应超出给定速度的±5%范围。

5.7.2.6 无线控制

5.7.2.6.1 辅助控制箱和主控制箱之间采用无线技术传输信号时，传输可靠性、抗干扰性和响应时间不应影响其停车控制。

5.7.2.6.2 无线控制系统所具备的控制魔毯的能力应能实施自动连续监控，在传输信号降级（如降低信号电平、电池电量低）时应能发出声音或视觉警告。

- 5.7.2.6.3 应采取措施防止机械响应非预定无线操作控制箱发出的信号。
- 5.7.2.6.4 在失电、通讯丢失、部件故障后，无线控制的辅助控制箱的重新启动不应导致紧急停车状态的复位。

5.7.3 通信与信号显示

5.7.3.1 通信

- 5.7.3.1.1 应配备线路广播或手持扩音装置，当设备出现异常停车时可以及时通知滑雪者相关情况和恢复运行的可能等候时间。
- 5.7.3.1.2 下站（上车区）和上站（下车区）之间应设专用电话或者配备对讲机。

5.7.3.2 信号显示

- 5.7.3.2.1 应配备运行计时器并显示运行累计时间。

- 5.7.3.2.2 应至少显示下列运行参数：

- a) 电流；
- b) 电压；
- c) 运行速度。

- 5.7.3.2.3 应至少显示下列故障信号：

- a) 电源异常（如缺相、过压、欠压）；
- b) 紧急停车；
- c) 防跌倒监控装置动作；
- d) 防卷入监控装置动作；
- e) 输送带在驱动滚筒上打滑；
- f) 逆转；
- g) 检修盖板移动；
- h) 加热融雪装置导热液体不足；
- i) 驱动异常（如过流）。

5.7.4 电流保护和大气放电保护

魔毯所有金属部件、主控制箱的外壳应直接、永久接地。

6 安装

6.1 线路基础

- 6.1.1 线路基础的施工宜按照 GB 51004 的有关规定进行。
- 6.1.2 线路基础应有施工记录并宜按照 GB 50202 的有关规定进行竣工验收。
- 6.1.3 线路基础竣工验收的程序和组织宜按照 GB 50300 的有关规定进行。

6.2 设备安装的基本要求

- 6.2.1 安装魔毯时应有魔毯安装指导书、电气配线图、基础图等技术文件。
- 6.2.2 安装单位应根据魔毯工程设计要求和安装技术要求，编制安装施工方案。
- 6.2.3 安装单位应在安装前检查魔毯的现场安装条件，如果地面存在滑坡风险或横向坡度，应首先采取措施消除风险。
- 6.2.4 安装单位应在安装前对土建基础进行检查，并查验基础的竣工验收报告。
- 6.2.5 安装单位应在安装前检查确认所安装设备与设计文件的一致性。设备不应有变形、损伤和锈蚀。
- 6.2.6 运输与保管过程中不能防止灰尘或杂物进入运动部位的机械设备，在安装前应进行解体检查和二次清洗，必要时重新更换全部润滑剂。
- 6.2.7 机械设备通用部分的安装应符合 GB 50231 和设备技术文件的有关要求。
- 6.2.8 电气设备的安装应符合 DL/T 5161.5、DL/T 5161.6、DL/T 5161.8、DL/T 5161.12 和设备技术文件的有关要求。

6.2.9 魔毯安装后，安装单位与魔毯的制造商应共同对下列情况进行验证确认：

- a) 防护、警示标志、控制箱的装配对安装技术文件和本文件的符合性；
- b) 魔毯周围安全净空、防护装置的安全距离、零部件几何尺寸对安装技术文件和本文件的符合性；
- c) 安全保护装置的正常运行；
- d) 紧急停车装置、报警器、故障显示的正常运行。

6.3 驱动装置、迂回装置和张紧装置的安装

6.3.1 电机的安装应符合 DL/T 5161.7 和设备技术文件的有关要求。

6.3.2 减速机的安装应符合制造商以及 GB 50231 的有关要求，所加润滑油的牌号和数量应符合使用维护说明书的要求。

6.3.3 安装制动器时应检查和确认以下内容：

- a) 落闸、开闸动作灵活可靠；
- b) 落闸时制动片与闸盘全接触，开闸时制动片与闸盘的间隙分布均匀并在允许的范围之内；
- c) 制动行程应留有余量，能补偿制动片的磨损。

6.3.4 采用液压张紧方式时，液压张紧装置的安装应按照 GB 50231 的有关要求执行。安装后油压显示值应与设计一致。

6.3.5 张紧小车的行走轮应与行走轨道接触良好。

6.3.6 采用重锤张紧时，重锤上下升降自由无卡阻现象，导向轮运转灵活无异响。

6.4 线路设备的安装

6.4.1 魔毯安装后输送带中心线在水平面上的投影线应为一条直线，输送带在最大速度运行中应保持顺直，并且在任何情况下不应从保护盖板中被拉出。

6.4.2 魔毯沿线各处的纵向坡度应与安装指导书注明的坡度一致。

6.4.3 魔毯的高度以及横向水平度调整后应紧固高低调节装置，并设置有效的防松措施。

6.4.4 魔毯底部支撑及所有部件相互间的连接应稳固，运行中不应出现晃动、移位或过大的振动。

6.4.5 安装前检查托辊是否转动灵活、无异响，安装后每个托辊应与输送带下表面接触。

6.4.6 底部支腿安装后与水平面应垂直。

7 试验与检验

7.1 基本要求

7.1.1 魔毯应在设备安装后进行试车，试车包括单机（装置或部件）试车、整机无负荷试车、整机负荷试车。

7.1.2 魔毯应在检验合格后投入运营使用，在第一次使用魔毯前以及每年启用魔毯前，魔毯的运营使用单位应组织检验工作，检验宜由有资质的第三方检验机构进行。

7.2 试车

7.2.1 单机（装置或部件）试车

7.2.1.1 驱动装置的所有部件组装完成后，在输送带安装前，应进行单机试车，在名义速度下的连续运转时间不应小于 2.5 h。

7.2.1.2 驱动装置运行应平稳，电机和减速机外壳温升、轴承温升不应超过使用维护说明书的规定，润滑和密封良好，不应渗油。

7.2.1.3 液压张紧装置应进行加压和泄压试验，额定压力持续加压时间不应小于 1 h。

7.2.1.4 加热融雪装置应进行加热试验，加热管的工作温度应能达到设计温度，试验时间不应小于 1 h。

7.2.2 整机无负荷试车

7.2.2.1 空载下正常无故障连续循环运行时间不应小于 2 h。

- 7.2.2.2 魔毯启动、运行、停止应平稳，无异常声响。
- 7.2.2.3 驱动滚筒、迂回滚筒、转向滚筒、线路托辊转动应灵活、无卡阻。
- 7.2.2.4 输送带在运行中不应出现左右摆动或偏向一侧导轨。
- 7.2.2.5 应验证空载下魔毯的以下基本性能：
 - a) 输送带的运行速度应符合 4.1.5 的要求；
 - b) 工作（正常）停车应符合 5.7.2.3.7 的要求；
 - c) 紧急停车应符合 5.7.2.3.9 的要求；
 - d) 启动和紧急停车时回程输送带挠度应符合 5.5.3.6 的要求；
 - e) 采用液压张紧时，张紧油压应稳定，并且应符合 5.3.6.1.5 的要求；采用重锤张紧时，应符合 5.3.6.2.1 和 5.3.6.2.3 的要求；
 - f) 上站（下车区）防跌倒监控装置应符合 5.6.2.1 和 5.6.2.2 的要求；
 - g) 上站（下车区）防卷入监控装置应符合 5.6.3.1 的要求；
 - h) 输送带打滑、逆转监控装置应符合 5.6.4.3 和 5.6.4.4 的要求。

7.2.3 整机负荷试车

应在满载工况下验证魔毯的以下性能：

- a) 输送带的运行速度应符合 4.1.5 的要求；
- b) 满载工况的启动应符合 5.3.2.1 的要求；
- c) 工作（正常）停车应符合 5.7.2.3.7 的要求；
- d) 紧急停车应符合 5.7.2.3.9 的要求；
- e) 输送带不应跑偏，输送带防跑偏装置应能自动阻止输送带跑偏；
- f) 启动和紧急停车时回程输送带挠度应符合 5.5.3.6 的要求；
- g) 采用液压张紧时，张紧油压应稳定，并且应符合 5.3.6.1.5 的要求；采用重锤张紧时，应符合 5.3.6.2.1 和 5.3.6.2.3 的要求；
- h) 满载工况启动和紧急停车时，线路的底部支承结构应满足 5.5.6.2.3 的要求；
- i) 满载工况下，线路基础应满足 5.5.7.3 的要求。

7.3 第一次运营使用前的验收检验

7.3.1 应在试车结束后、第一次运营使用前对魔毯进行验收检验，验证设备参数和性能是否满足第 4 章～第 6 章的要求。

7.3.2 制造商应至少提供下列资料用于验收检验：

- a) 技术图纸；
- b) 使用维护说明书；
- c) 基础图。

7.3.3 验收检验宜参照附录 A 中表 A.1 所列项目和方法进行验证。

8 运营与维护

8.1 基本要求

8.1.1 使用维护说明书应至少包括以下内容：

- a) 设备结构组成；
- b) 技术性能及参数；
- c) 适用范围和使用环境条件；
- d) 设置和调整；
- e) 操作说明；
- f) 监测、检查、测试的项目和周期；
- g) 所有润滑点的位置，润滑油更换周期，以及要使用的润滑品的质量和标号；
- h) 定期更换的零件目录，包括更换的品种、数量、周期；
- i) 运动部件的维护调校内容和时间间隔；

- j) 需观测的间隙；
- k) 输送带老化检查周期及其修复说明；
- l) 故障的排查、识别和处理；
- m) 电机、减速机、驱动滚筒等机电设备的大修时间；
- n) 重要零部件和设备的建议寿命；
- o) 停用、存储、移动和拆除；
- p) 操作和维修人员的配置；
- q) 紧急情况下（如突发停机或事故）的处理方法；
- r) 防风和防雨的建议。

8.1.2 运营使用单位对魔毯的操作使用与维修保养应按照使用维护说明书的要求进行。

8.2 人员

8.2.1 魔毯管理人员

8.2.1.1 魔毯的运营使用单位应配备安全管理人员负责魔毯的管理工作，承担相应的管理职责。

8.2.1.2 安全管理人员应负责下列各项管理制度的制定和贯彻执行：

- a) 魔毯各岗位职责；
- b) 安全操作规程；
- c) 日常检查制度；
- d) 维护保养制度；
- e) 操作人员和维修人员的培训考核制度；
- f) 意外事件或者事故的应急救援预案；
- g) 安全技术档案管理制度。

8.2.1.3 安全管理人员应负责制定下列运行措施：

- a) 发现设备异常或发生故障时如何排除的措施；
- b) 安全保护装置动作引起魔毯停车时，检查排除及重新运行的措施；
- c) 恶劣天气条件威胁到运行安全时停车处理办法；
- d) 能见度不足时的运行措施；
- e) 夜间运行的措施；
- f) 清除输送带表面或机械部件上的冰和积雪的措施；
- g) 上下站操作人员或服务人员临时离开，其职责转给其他工作人员的条件及方法。

8.2.2 魔毯操作和维修人员

8.2.2.1 魔毯操作人员应经过培训，熟悉魔毯各部件的构造和技术性能，有能力对任何停车和故障报警作出响应并采取必要措施。

8.2.2.2 维修人员应是被授权人员，并在开展魔毯的维修工作前应经过培训且考核合格。

8.2.2.3 维修人员应熟悉魔毯各部分的结构原理和维修保养方法。

8.2.2.4 魔毯运行时，上下站应至少各有 1 名操作人员在岗。

8.2.2.5 运行中如发生紧急情况，操作人员应迅速按下急停开关。

8.2.2.6 操作人员应阻止不按间距要求乘用魔毯的行为，防止魔毯超载运行。

8.3 档案

8.3.1 魔毯的运营使用单位应建立健全安全技术档案。安全技术档案应至少包括但不限于以下内容：

- a) 技术图纸；
- b) 整机合格证；
- c) 使用维护说明书；
- d) 基础工程的竣工验收报告；
- e) 检验报告；
- f) 设备修理和更换记录；
- g) 设备运行故障和事故记录；

- h) 人员培训考核记录;
 - i) 日常使用状况和维护保养记录;
 - j) 定期检查维护记录。
- 8.3.2 应委派专人保管安全技术档案,对于设备的任何技术修改应在存档资料上进行变更说明。
- 8.3.3 宜对所有资料建立电子档案。

8.4 运行

8.4.1 基本要求

- 8.4.1.1 魔毯不应用来完成设计规定以外的任务,也不应在非正常工作条件下运行。
- 8.4.1.2 魔毯的运营使用单位不应随意改变下站(上车区)及上站(下车区)位置、上车板及下车板倾角、增大输送量或进行其他影响设备性能的改动。
- 8.4.1.3 所有的启动操作应由经过培训的操作人员执行。
- 8.4.1.4 魔毯停机一个月以上重新运行前,应对所有的机械、电气设备进行检查、调整和测试,确认正常后方可运行。
- 8.4.1.5 应配备安全剪刀、安全刀具等安全应急处理工具,并妥善保管。
- 8.4.1.6 魔毯运行时,只允许运输穿戴滑雪器具、滑雪靴并可能携带滑雪装备的滑雪者,并且滑雪者在输送带上的间距应符合制造商的规定。
- 8.4.1.7 魔毯的运营使用单位应采取防范措施、消除或降低风险,魔毯的重大风险清单见附录B中表B.1。

8.4.2 运行前要求

- 8.4.2.1 每天开始运行之前,操作人员应至少进行下列项目的检查和确认:
 - a) 电源电压正常;
 - b) 液压张紧压力表显示值正常;
 - c) 张紧装置(重锤、油缸、张紧小车)在正常行程范围之内;
 - d) 加热融雪装置内导热液体处于正常液位指示标线之上;
 - e) 各警示标志清晰可见;
 - f) 输送带表面的积雪与冰层已清除;
 - g) 驱动装置、迂回装置内部的积雪、积水和冻冰已清理;
 - h) 输送带清扫装置未冻住、无卡阻;
 - i) 加热融雪装置的集水箱与排水管未冻结;
 - j) 防跌倒监控光学检测装置表面无积雪、无结冰;
 - k) 输送带和接头无开裂和变形;
 - l) 上站(下车区)和下站(上车区)的盖板安装牢固,未出现移动;
 - m) 上下站畅通,输送带上无杂物,魔毯周围无人员施工作业;
 - n) 通信设备完好。
- 8.4.2.2 每天开始运行之前,操作人员应至少进行下列项目的测试:
 - a) 所有按钮、指示灯功能测试;
 - b) 所有急停开关动作是否灵活、按下后能否使魔毯立即停车测试;
 - c) 防跌倒监控装置、防卷入监控装置功能测试;
 - d) 制动器制动可靠性测试;
 - e) 开机运转测试,输送带至少循环一圈,查看电机运转是否平稳、有无异常噪声;
 - f) 全线运转测试时检查输送带有无打滑、跑偏、刮卡,运行中是否沿中心线顺直运行。
- 8.4.2.3 对于长期未运行的魔毯,应经过全面的检查和调试合格后,方可重新投入运行。

8.4.3 运行中要求

- 8.4.3.1 控制面板上的各种信号指示灯应正常,如出现异常应及时查明原因。
- 8.4.3.2 机电设备运转应无异常噪声或外壳异常温升。
- 8.4.3.3 魔毯如发生紧急停车,应查明原因,采取有效措施排除故障后方可再次启动。

8.4.3.4 主控制箱和辅助控制箱柜门应闭锁。

8.4.3.5 输送带偏向一侧或左右摆动时，应及时调整。

8.4.4 停运后要求

8.4.4.1 魔毯处于停止、断电状态方可进行下站（上车区）和上站（下车区）输送带内部清理，此时主开关应锁定在断开位置。

8.4.4.2 造雪期间，宜应用防水材料覆盖魔毯。

8.4.5 夜间运行要求

8.4.5.1 夜间运行时，魔毯的上下站及全线路应有照明。

8.4.5.2 照明装置的照度应使滑雪者看清标志和标识、上下站的地面、运行中的输送带，工作人员应可看清控制箱和输送带上滑雪者情况。

8.5 维护

8.5.1 定期检查维护

运营使用单位应根据制造商提供的使用维护说明书，对每条魔毯制定维护计划和定期检查计划。每月应着重检查并确认以下内容：

- a) 安全防护罩和护栏应固定牢固；
- b) 张紧移动小车导轨面应清洁，无杂物阻碍行进；
- c) 液压张紧系统的油压应正常，管路应无渗漏；
- d) 上车板、下车板、安全活动板、线路侧面导向板和盖板应无翘曲变形、异物突出、开裂、紧固螺钉松动；
- e) 驱动装置、迂回装置、线路的防输送带跑偏装置应运行正常，磨损应未超限；
- f) 输送带接头应连接牢固，无脱落、拉裂变形或者拉伸量超限；
- g) 安全活动板与输送带的间隙应正常；
- h) 制动器的动作及制动片的磨损应正常；
- i) 安全检测装置应固定牢固、与被监测物体间距应正常、开关接线应无老化松动；
- j) 驱动装置和迂回装置内从动导向滚筒和沿线托辊的转动应正常；
- k) 魔毯下部支承结构应固定牢固，无偏斜、移位、变形、松动，支撑点基础应无沉降、塌陷；
- l) 线路中段机身的直线度应符合要求，整体无变形、连接处无松动；
- m) 底部支腿与水平面应保持垂直；
- n) 输送带表面应无破损和裂开；
- o) 输送带清扫装置、刮冰器与滚筒的间隙应符合要求；
- p) 加热融雪装置应无损坏、液体应无泄露；
- q) 安全保护装置应校验和测试正常；
- r) 减速机应无渗漏现象，润滑油量符合要求；
- s) 设备或工作区的尺寸以及相邻设备的间隙应符合本文件的规定；
- t) 主控制箱和辅助控制箱内电器元器件、接线头、电线应无损坏、变形、老化、松动。

8.5.2 检查维护记录

8.5.2.1 应将检查、调整、维护、修理、更换的作业情况记入定期检查维护记录中。

8.5.2.2 记录存档时间应不少于 2 年。

9 标识

9.1 基本要求

9.1.1 标志应设置在醒目的位置。

9.1.2 标志牌应采用坚固耐用的材料制作，字迹和色彩应能适应滑雪场的环境条件而不被损坏。

9.1.3 标志牌的尺寸和设置的高度应符合 GB 2894 的规定。

9.1.4 标志牌上标志的下方宜设置符合 GB 2894 规定的中英文文字辅助标志。

9.1.5 根据需要，可选择使用 GB 2894 规定的其他标志，也可参照 GB/T 2893.1 和 GB/T 2893.3 的规定设计标志。

9.2 产品标识

9.2.1 魔毯应在可见的适当位置粘贴清晰、永久的产品标识（铭牌）。

9.2.2 产品标识（铭牌）应至少包括以下信息：

- a) 产品名称；
- b) 型号或出厂编号；
- c) 主要技术参数；
- d) 制造商全称和地址；
- e) 制造日期。

9.3 安全标识

9.3.1 向乘用魔毯的滑雪者传递相关信息的安全标志应至少包括指令标志和禁止标志。

9.3.2 应有清晰、易懂的标识对滑雪者以下行为进行安全提示：

- a) 下站（上车区）进入魔毯的行为；
- b) 正常运行时的乘用行为；
- c) 运行过程中停机时的乘用行为；
- d) 上站（下车区）离开魔毯的行为。

9.3.3 在维护、修理、检查或类似的工作期间，魔毯的下站（上车区）及上站（下车区）应设置适当的装置阻止未被授权人员进入，并标明“设备检修，不准靠近”字样。

9.3.4 安全标志应符合 GB/T 40232 和 BS EN 15700 的规定。

9.4 乘客须知

应至少在下站（上车区）附近设置乘客须知，包括但不限于以下内容：

- a) 不适宜乘用的群体；
- b) 儿童等特殊人群由成人陪同乘用；
- c) 对穿戴和握持雪具的要求；
- d) 乘用魔毯前检查整理好长发以及围巾、手套、雪杖等物，防止卷入输送带内；
- e) 依次排队，严禁强行插队；
- f) 下站（上车区）禁止长时间逗留的要求；
- g) 人员站立保持安全间距的要求；
- h) 不应在输送带上走、跑、躺、卧、蹲、坐等；
- i) 乘用期间不应吸烟、嬉戏打闹、乱扔垃圾；
- j) 中途不应擅自跳下或登爬魔毯；
- k) 摔倒、衣物被夹住时的紧急处理方法；
- l) 到达上站（下车区）提起雪杖并及时离开的要求；
- m) 急停按钮的使用和禁用条件；
- n) 不应私自触碰操作箱内的各种开关、按钮的要求。

附 录 A
(资料性)
验收检验的项目和验证方法

验收检验的项目和验证方法见表A.1。

表A.1 验收检验的项目和验证方法

序号	项目	条款	验证方法				
			试验	测量	计算	查阅资料	目测
1	线路的规划设计与计算	4					
1.1	线路最大坡度	4.1.2.1		×			
1.2	坡度差	4.1.2.2		×			
1.3	横向自由净空	4.1.3.1		×			×
1.4	离地高度	4.1.3.2		×			
1.5	上方自由净空和顶棚	4.1.3.3		×			×
1.6	沿线电控装置安装	4.1.3.4					×
1.7	安全网或雪墙	4.1.4.1		×			×
1.8	并行魔毯净空	4.1.4.2		×			
1.9	运行速度	4.1.5.1		×			
1.10	运送儿童速度	4.1.5.2		×			
2	设施设备	5					
2.1	上车板安装	5.2.1.1		×			
2.2	上车板离地高度	5.2.1.2		×			
2.3	下站(上车区)输送带坡度	5.2.1.3		×			
2.4	上车板与输送带间隙	5.2.1.4		×			
2.5	上站(下车区)最末段输送带坡度	5.2.2.1		×			
2.6	上站(下车区)倒数第二段坡度	5.2.2.2		×			
2.7	下车坡度	5.2.2.3		×			
2.8	安全活动板与下车板宽度			×			
2.9	安全活动板与下车板长度	5.2.2.4		×			
2.10	下车板离地高度			×			
2.11	安全活动板与输送带间隙	5.2.2.5		×			
2.12	下车板与安全活动板间隙			×			
2.13	满载启动	5.3.2.1	×				
2.14	驱动滚筒表面材料	5.3.3.1					×
2.15	上站(下车区)滚筒直径	5.3.3.2		×			
2.16	制动器性能	5.3.5.1 5.3.5.2 5.3.5.3	×				×

表 A.1 (续)

序号	项目	条款	验证方法				
			试验	测量	计算	查阅资料	目测
2.17	液压张紧压力显示	5.3.6.1.1					×
2.18	液压张紧保压功能	5.3.6.1.2					×
2.19	液压张紧防冻措施	5.3.6.1.4				×	×
2.20	油缸杆位置	5.3.6.1.5	×				
2.21	重锤上下移动	5.3.6.2.1	×				
2.22	重锤井	5.3.6.2.2					×
2.23	重锤位置	5.3.6.2.3	×				×
2.24	输送带防跑偏装置	5.3.7					×
2.25	冰雪刮除器	5.4.1.1	×	×			×
		5.4.1.2					
2.26	输送带自动清扫装置	5.4.2.1	×	×			×
		5.4.2.2					
2.27	加热融雪装置设置	5.4.3.1	×			×	
2.28	加热融雪装置加热器	5.4.3.2	×			×	
2.29	加热融雪装置集水箱	5.4.3.3				×	×
2.30	输送带表面防滑	5.5.1.2	×				
2.31	单人输送带的有效宽度	5.5.1.3		×			
2.32	输送带横向坡度	5.5.1.4		×			
2.33	输送带接头间隙	5.5.1.6		×			
2.34	托辊材料	5.5.2.2				×	×
2.35	托辊轴承	5.5.2.3				×	×
2.36	托辊间隙	5.5.2.4		×			
2.37	输送带侧面导轨	5.5.3.1					×
2.38	输送带侧面导向板高度	5.5.3.2		×			×
2.39	导向板的横向距离	5.5.3.3		×			
2.40	导向板与输送带间隙	5.5.3.4		×			
2.41	回程输送带导向	5.5.3.5					×
2.42	回程输送带挠度	5.5.3.6	×				
2.43	输送带侧面保护盖板性能	5.5.4.1					
		5.5.4.3	×				×
		5.5.4.5					
2.44	保护盖板高度	5.5.4.2		×			
2.45	保护盖板宽度	5.5.4.4		×	×		
2.46	线路检修便道	5.5.5.1					×
2.47	机架侧面保护罩	5.5.5.2					×
2.48	线路支承结构	5.5.6.1.2					
		5.5.6.2.1	×			×	×
		5.5.6.2.3					

表 A.1 (续)

序号	项目	条款	验证方法				
			试验	测量	计算	查阅资料	目测
2.49	线路基础承载能力	5.5.7.3	×				
2.50	运动件防护隔离	5.6.1.1					×
2.51	上站(下车区)防跌倒监控	5.6.2.1 5.6.2.2	×	×			
2.52	上站(下车区)防卷入监控触发	5.6.3.1	×	×			
2.53	安全活动板打开宽度	5.6.3.2 5.6.3.5	×	×			
2.54	安全活动板最大打开力	5.6.3.3	×	×			×
2.55	安全活动板安装位置	5.6.3.4		×			
2.56	输送带打滑、逆转监控	5.6.4.3 5.6.4.4	×				
2.57	检修盖板监控	5.6.5.1 5.6.5.2	×				
2.58	多条连续无中间出口保护	5.6.6	×				
2.59	工作(正常)停车开关	5.7.1.2	×				×
2.60	紧急停车开关	5.7.1.3.1 5.7.1.3.2 5.7.1.3.3 5.7.1.3.4	×				×
2.61	主开关	5.7.1.4.1 5.7.1.4.2	×				×
2.62	辅助设备开关	5.7.1.5	×				×
2.63	主控制箱安装	5.7.1.6.1.1 5.7.1.6.1.3					×
2.64	主控制箱面板功能	5.7.1.6.1.2	×				×
2.65	主控制箱恒温加热	5.7.1.6.1.5	×				
2.66	辅助控制箱	5.7.1.6.2.1 5.7.1.6.2.2	×				×
2.67	控制系统常规电路保护	5.7.2.1.1	×				
2.68	控制系统故障记忆功能	5.7.2.1.2	×				
2.69	启动电铃或警示灯	5.7.2.3.3	×				
2.70	故障复位	5.7.2.3.5	×				
2.71	紧急停车报警声	5.7.2.3.6	×				
2.72	工作(正常)停车	5.7.2.3.7 5.7.2.3.8	×				×
2.73	紧急停车	5.7.2.3.9	×	×			×
2.74	停电制动	5.7.2.3.11	×				×
2.75	电控系统安全电压	5.7.2.4		×			
2.76	线路广播或扩音器	5.7.3.1.1	×				
2.77	电话或对讲机	5.7.3.1.2	×				

表 A.1 (续)

序号	项目	条款	验证方法				
			试验	测量	计算	查阅资料	目测
2.78	运行计时器	5.7.3.2.1					×
2.79	运行指示信号	5.7.3.2.2 5.7.3.2.3					×
2.80	接地保护	5.7.4					×
3	安装	6					
3.1	张紧小车行走轮	6.3.5					×
3.2	重锤导向轮	6.3.6					×
3.3	输送带运行	6.4.1	×				
3.4	底部支腿调节防松	6.4.3					×
3.5	线路设备连接	6.4.4	×				×
3.6	托辊转动	6.4.5	×				×
3.7	底部支腿垂直安装	6.4.6		×			
注：表中符号“×”表示对应的验证方法。							

附 录 B
(资料性)
魔毯重大风险清单

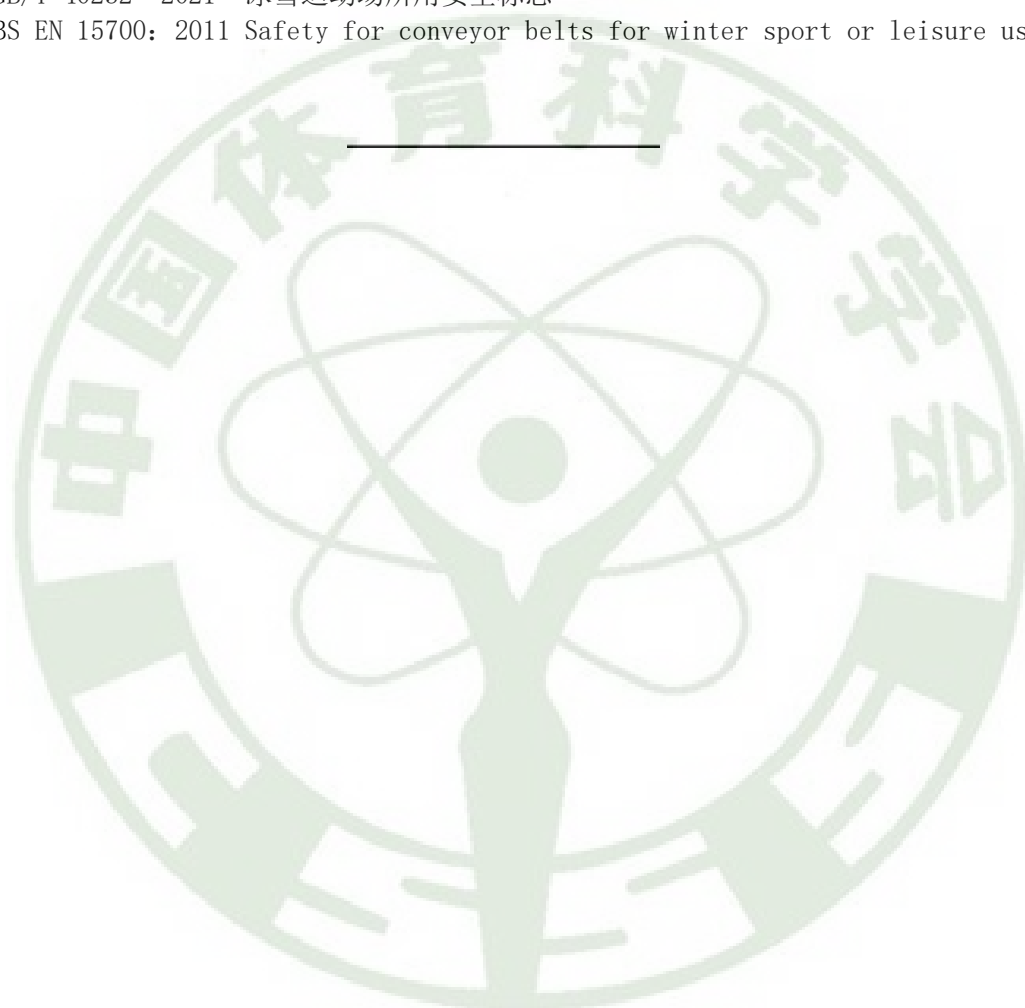
魔毯重大风险清单见表 B.1。

表B.1 魔毯重大风险清单

风险名称	风险部位	风险内容
1. 跌落	输送带	滑雪者自身未站稳或滑倒，跌落到魔毯上或从魔毯上摔下来
		由于魔毯速度的变化或滑雪者和皮带之间的速度差异摔倒
		魔毯的意外启动导致滑雪者跌倒
		魔毯反转导致滑雪者滚落
		突发大风直接吹倒或输送带的舞动导致滑雪者未站稳而跌落
		滑雪者意外触碰急停按钮，魔毯骤停导致滑雪者跌倒
		坡度过大或坡度差过大导致滑雪者未站稳跌倒
	上车板、下车板	魔毯意外失稳或倒塌使滑雪者摔倒
		输送带断裂导致滑雪者滚落
		下站（上车区）人员拥挤，被挤倒跌落
2. 碰撞（冲击）	魔毯下站（上车区）、 上站（下车区）	夜间运行时，下站（上车区）或上站（下车区）照明不足，导致滑雪者踏空跌落
		上车板断裂，导致滑雪者跌入迂回装置内
	输送带	拥堵导致滑雪者相互碰撞
		地面湿滑摔倒后与其他滑雪者或地面硬物碰撞
3. 挤压	输送带	被其他滑雪者滑雪器具、雪杖撞击
		自身未站稳与前后方其他滑雪者碰撞，或碰撞到滑雪器具上受伤
		大风或急停导致人员相互撞击
4. 缠住	线路滑雪者导向板	与魔毯周边障碍物（如控制箱）碰撞
		滑雪者滚落时在输送带上互相挤压
5. 卷入	滑雪者肢体和头部落入安全活动板下方受挤压	
	线路滑雪者导向板	导向板裂口处缠住滑雪者衣物
6. 刺伤（切割）	线路滑雪者导向板	滑雪者的围巾、手套、衣物卷入输送带与侧面导向板之间
	安全活动板	因输送带与安全活动板之间的间隙过大或滑雪者没有整理好围巾、手套、衣物、雪杖、头发等，导致滑雪者卷入
7. 摩擦（剪切）	下站（上车区）	大风刮倒标志牌，刺伤滑雪者
	线路盖板和滑雪者导向板	滑雪者跌倒后被锋利的凸起物刺伤
8. 电击	输送带	滑雪者摔倒后被魔毯拖行
	线路滑雪者导向板	儿童滑雪者手指伸入输送带与侧面导向板之间
9. 烫伤	驱动装置	操作或维修人员检查维护时接触带电部件
	加热融雪装置	操作或维修人员检查维护时触碰加热管等加热部件

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- [2] GB 50300—2013 建筑工程施工质量验收统一标准
- [3] GB 51004—2015 建筑地基基础工程施工规范
- [4] GB/T 2893.1—2013 图形符号 安全色和安全标志 第1部分：安全标志和安全标记的设计原则
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Social Organization Standard Of China Sport Science Society

T/CSSS 015—2024

Safety requirements for conveyor
belts for skiing

滑雪用魔毯安全要求

(English Translation)

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Foreword

This document is drafted in accordance with the rules given in the GB/T 1.1—2020 *Directives for standardization—Part 1: Rules for the structure and drafting of standardizing documents*.

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. The issuing body of this document shall not be held responsible for identifying any or all such patent rights.

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Introduction

Conveyor belt for skiing is a kind of stationary driving equipment that uses a circulating conveyor belt to transport skiers from the bottom station (boarding area) to the top station (landing area). Along with the development of domestic skiing, Conveyor belt has been widely used in ski resorts, and has become a crucial personnel transportation equipment in ski resorts.

This document is formulated to further promote the standardization and development of ski conveyor belt technology, improve the technical level and operational safety of the industry, protect the personal safety of the users, reduce the occurrence of malfunctions and accidents, and make the conveyor belt become a safe transportation equipment in ski resorts. This document puts forward the basic safety requirements of conveyor belts for skiing, aiming to provide an effective technical basis for the design, manufacture, installation, use, inspection and management of conveyor belts for skiing in China.



Safety requirements for conveyor belts for skiing

1 Scope

This document specifies the line planning, design and calculation, facilities and equipments, installation, testing and inspection, operation and maintenance, marking and labeling of conveyor belts for skiing.

This document is applicable to the design, manufacture, installation, inspection, use and maintenance of conveyor belts for skiing that utilize a multilayer structure of continuous tape as a conveyor belt.

This document is not applicable to conveyor belts that use standard chain plates.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 2894, *Safety signs and guideline for the use*

GB 50007, *Code for design of building foundation*

GB 50009—2012, *Load code for the design of building structures*

GB 50010, *Code for design of concrete structures*

GB 50231, *General code for construction and acceptance of mechanical equipment installation engineering*

DL/T 5161.5, *Specification for construction quality checkout and evaluation of electric equipment installation—Part 5: Cable line*

DL/T 5161.6, *Specification for construction quality checkout and evaluation of electric equipment installation—Part 6: Earthing device*

DL/T 5161.7, *Specification for construction quality checkout and evaluation of electric equipment installation—Part 7: Electrical rotating machines*

DL/T 5161.8, *Specification for construction quality checkout and evaluation of electric equipment installation—Part 8: Switchboard outfit complete cubicle and secondary circuit*

DL/T 5161.12, *Specification for construction quality checkout and evaluation of electric equipment installation—Part 12: Low-voltage apparatus*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

conveyor belts

continuous transportation equipment for transporting skiers by means of a powerdriven method using a moving conveyor belt, where the carrying surface is kept parallel to the direction of moving and skiers are transported standing up on it

Note: According to the different applications, conveyor belts are mainly divided into snow conveyor belts for skiing and conveyor belts for non-skiing entertainment.

3.2

boarding plate

installed at the end of the conveyor belt bottom station (boarding area), it also serves as a cover for the return device and assists the skier in stepping onto the fixed flat surface of the conveyor belt

3.3

safety flap

a movable flat plate mounted at the end of the conveyor belt at the conveyor belt top station (landing area), above the drive or return roller

Note: When the conveyor belt is in its normal state, the safety flap covers the end return area of the conveyor belt around the rollers. When a foreign object becomes entangled between the conveyor belt and the safety flap, the plate can be parallelly pushed or rotated to open the safety flap and the conveyor belt shall be stopped.

3.4

landing plate

installed at the top station (top station), behind the safety activity plate, with a downward slope, to support the skier quickly out of the fixed plate at landing area (top station)

3.5

nominal speed

the speed of a conveyor belt in the direction of travel at rated frequency and rated voltage and with no load, as determined by the manufacturer's design

3.6

effective width

Horizontal transverse distance between the guide plates on both sides of the belt

3.7

authorized person

persons authorized by the person in charge of the conveyor belt operating unit to enter the area on the conveyor belt, inside the frame, or adjacent areas around the equipment for maintenance, inspection, or rescue operations

4 Planning, design and calculation of lines

4.1 Planning and design of the line

4.1.1 Line selection

4.1.1.1 Conveyor belts shall not be built in areas where avalanches, landslides, caves, wind gusts of magnitude 7 or higher are frequent and jeopardize the safety of the conveyor belt.

4.1.1.2 The projected line of the centerline of the conveyor belt line on the horizontal plane shall be a straight line.

4.1.1.3 The floor plan of the conveyor belt shall be laid out in such a way that the skier riding the carpet can safely exit the carpet at any point along the route in the event of a malfunction or stoppage of the carpet.

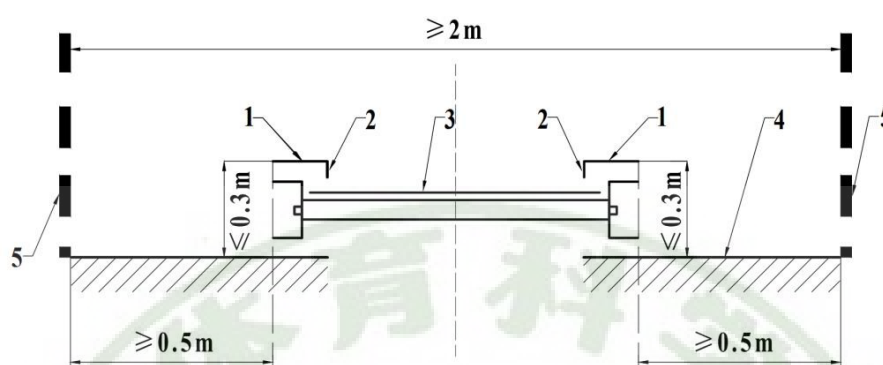
4.1.2 Line gradient

4.1.2.1 The maximum slope of the line shall not exceed 25% (14.04°).

4.1.2.2 The difference in slope between two consecutive sections of each conveyor belt conveyor belt shall not exceed 12.5% (7.13°), the slope of each section shall be constant and the length shall not be less than 1.5 m.

4.1.3 Free headroom on both sides and above the line

4.1.3.1 The lateral freeboard on both sides of the outdoor conveyor belt line shall not be less than 0.5 m, and the total lateral freeboard above the conveyor belt plane should be not less than 2 m. Except for electrical cabinets, emergency stop switches, and crowd monitoring devices that are required for safe operation, there should be no obstacles from the snow surface upwards in the freeboard on both sides, and the height of the snow surface shall not exceed the height of the upper surface of the conveyor belt (as shown in Figure 1).



Description of the citation sequence: 1—side cover; 2—side guide plate; 3—conveyor belt; 4—snow surface; 5—obstacles.

Figure 1 Schematic diagram of the headroom around the conveyor belt

4.1.3.2 The height between the snow surface and the upper surface of the side cover of the conveyor belt shall not exceed 0.3 m within the free headroom on both sides of the line (as shown in Figure 1).

4.1.3.3 The space above the upper surface of the conveyor belt shall be free space, except for the belt side covers and guide plates. The free space above shall be free of obstacles except for electrical cabinets, emergency stop switches, and crowd monitoring devices that are required for safe operation. If a roof is installed above, the clearance between the roof and the conveyor belt shall not be less than 2.3 m at the centerline.

4.1.3.4 If electrical cabinets, emergency stop switches, and crowd monitoring devices need to be installed in free space as defined in 4.1.3.1 and 4.1.3.3, these facilities should be guarded or measures taken to reduce the risk of injury to skiers.

4.1.4 Clearance to other surrounding facilities

4.1.4.1 A safety net or snow wall shall be provided between the conveyor belt and the ski slopes to prevent skiers from accidentally running into the conveyor belt line. The clearance between the safety net or snow wall and the conveyor belt shall be in accordance with 4.1.3.1.

4.1.4.2 Two parallel conveyor belts shall not have a clearance of less than 1 m from each other.

4.1.5 Running speed

4.1.5.1 The nominal speed of the conveyor belt shall not be greater than 0.75 m/s.

4.1.5.2 It shall be possible to transport children at a speed of 0.4 m/s or less.

4.2 Line calculation

4.2.1 Fundamental requirement

When designing the line, at least the load of the conveyor belt, the inertia force of the conveyor belt starting and stopping, the breaking strength of the conveyor belt, and the strength of the line load-bearing structural components shall be calculated and verified.

4.2.2 Load of conveyor belt

The self-weight of a skier on a conveyor belt wearing skis or boots or carrying ski equipment is calculated as 790 N per person on average. The minimum continuous uniformly distributed load is calculated as 1700 N/m².

4.2.3 Inertial force

The following inertia forces caused by the mass of the conveyor belt, the mass of the personnel and the mass of the rotating part driven by the conveyor belt shall be calculated for the line's fully loaded operating conditions:

- a) inertia force at normal start-up acceleration of 0.2 m/s²;
- b) inertia force at work stop deceleration of 0.05 m/s²~0.1 m/s²;
- c) inertia force when the distance of emergency stop is 0.3 m.

4.2.4 Conveyor belt breaking strength

4.2.4.1 The tensile safety coefficient of the conveyor belt and its joints, i.e. the ratio of the minimum breaking tension of the conveyor belt to the maximum working tension of the conveyor belt, shall not be less than 5.

4.2.4.2 The maximum working tension (F) of the conveyor belt shall be calculated according to formula (1):

$$F = f_1 + f_2 + f_3 + f_4 + f_5 \dots\dots\dots (1)$$

In equation:

F —the maximum working tension of the conveyor belt in Newtons (N);

f_1 —the maximum tension of the conveyor belt tensioning device in Newtons (N);

f_2 —the resistance of the conveyor belt on the line, including the resistance on the rollers and the resistance of the guides, in Newtons (N);

f_3 —the component force of gravity of the conveyor belt caused by the slope and the component force of the skier's own weight on the conveyor belt when it is fully loaded, in Newtons (N);

f_4 —the resistance of the conveyor belt to the relevant equipment within the drive and return, in Newtons (N);

f_5 —inertial force in Newtons (N) at startup of the conveyor belt at full load.

4.2.5 Strength of supporting structural elements in lines

4.2.5.1 The yield strength factor of safety for all elements of structural supporting shall not be less than 3.5.

4.2.5.2 The effects of the following types of loads shall be calculated for the design of supporting structural elements and civil infrastructure.

- a) maximum tension of the belt tensioner.
- b) conveyor belt equipment weighs itself.
- c) skiers' weights.
- d) inertial forces during belt starting and braking.
- e) wind load: calculated according to Chapter 8 and Appendix E of GB 50009—2012.
- f) snow load: calculated according to Chapter 7 and Appendix E of GB 50009—2012.

- g) the lower supporting structures and protective roof of the conveyor belt carry the ice load. The average thickness of the ice may be calculated as 25 mm or as provided by the local meteorological office, and the volumetric mass as 600 kg/m^3 .
- h) skier multiplication in the use of impact dynamic load on the rollers, dynamic load along the direction of operation on both sides of the line frame, the value is calculated as 25% of the actual load of one roller.

5 Facilities and equipments

5.1 Fundamental requirement

5.1.1 Conveyor belts shall have bottom station (boarding area) and top station (landing area).

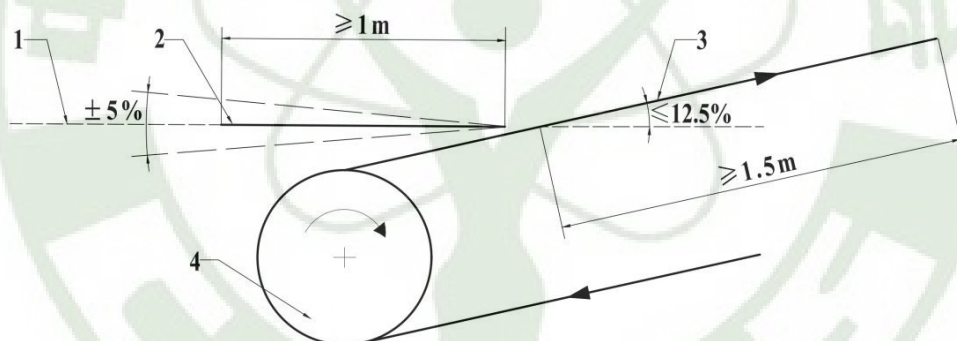
5.1.2 The conveyor belt shall consist of at least the following equipment:

- a) drives and returns;
- b) snow clearing and heating snow melting devices;
- c) line facilities;
- d) safety devices;
- e) electrical equipment.

5.2 Bottom station (boarding area) and top station (landing area)

5.2.1 Bottom station (boarding area)

5.2.1.1 A board with a single grade and a length of not less than 1 m should be installed at the end of the carpet bottom station (boarding area). The grade of the board shall be within $\pm 5\%$ ($\pm 2.86^\circ$) of the horizontal line (as shown in Figure 2).



Description of the citation sequence: 1—horizontal line; 2—boarding plate; 3—conveyor belt; 4—returning roller.

Figure 2 Schematic diagram of the boarding area

5.2.1.2 The height difference between any side of the board and the ground or snow surface shall not exceed 0.3 m.

5.2.1.3 The slope of the conveyor belt shall be uniform over a length of at least 1.5 m from the starting point of the ride on the belt, and the gradient difference in slope between the conveyor belt and the boarding plate should not be more than 12.5% (7.13°) (as shown in Figure 2).

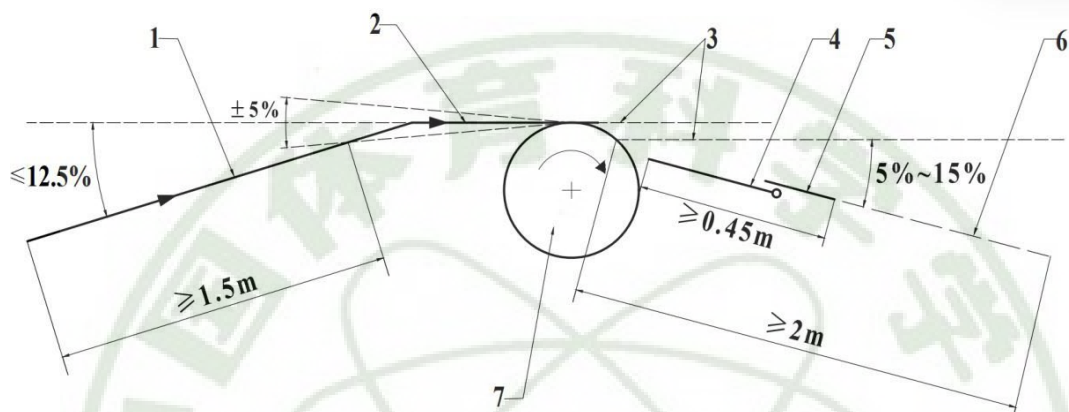
5.2.1.4 When the conveyor belt is running, the gap between the boarding plate and the surface of the conveyor belt should be 6 mm, and the maximum gap shall not exceed 15 mm.

5.2.2 Top station (landing area)

5.2.2.1 The slope of the last section of the conveyor belt near the top station (landing area) shall be uniform, and the gradient should be within $\pm 5\%$ ($\pm 2.86^\circ$) of the horizontal line (as shown in Figure 3).

5.2.2.2 The penultimate section of the conveyor belt should have a uniform slope over a length of not less than 1.5 m. The gradient difference between the conveyor belt and the endmost section should not be more than 12.5% (7.13°) (as shown in Figure 3).

5.2.2.3 Top stations (landing areas) other than the end of the conveyor belt shall have retrorse gradient 5% to 15% (2.86° to 8.53°) for a minimum length of 2 m (as shown in Figure 3). Safety plate and landing plate shall be installed at end of this area, the transverse width of plates shall not be less than the effective width of the conveyor belt.



Description of citation numbers: 1—conveyor belt (penultimate section); 2—last section of conveyor belt; 3—horizontal line; 4—safety plate; 5—landing plate; 6—snow surface; 7—drive roller.

Figure 3 Schematic diagram of pick-up (landing area)

5.2.2.4 The total length of the safety plate and the landing plate shall not be less than 0.45 m (as shown in Figure 3), and the height difference between any side of the plate and the ground or snow surface shall not exceed 0.3 m.

5.2.2.5 When the conveyor belt is in operation, the gap between the safety plate and the surface of the conveyor belt, and between the landing plate and the safety plate in normal condition shall not exceed 6 mm.

5.3 Drives and return devices

5.3.1 Fundamental requirement

5.3.1.1 The drive shaft of the drive unit, the cylinder of the drive roller, and the cylinder of the return roller shall be made of materials with sufficient toughness and elongation even at low temperatures of -20°C or less.

5.3.1.2 The cylinder of drive roller and return roller as well as the drive shaft shall be calibrated for yield strength safety factor, which should not be less than 3.5; the drive shaft should be calibrated for fatigue strength safety factor, which shall not be less than 2.2.

5.3.2 Drive performance

5.3.2.1 The drive shall be capable of starting with an average acceleration of at least 0.1 m/s^2 under full load conditions.

5.3.2.2 The drive shall be able to stop automatically if any of the following conditions occur during operation:

- a) no voltage or voltage is reduced below a specific minimum value;
- b) power consumption rises above a specific maximum value;
- c) any of the safety protection devices is triggered.

5.3.3 Drive and return rollers

5.3.3.1 The surface of the drive roller shall be evenly covered with a patterned rubber layer or other non-slip material that increases friction.

5.3.3.2 The diameter of the drive rollers installed in the top station (landing area) shall not be less than 180 mm.

5.3.3.3 When manufactured by welding process, the weld shall be free from cracks and under-welding, and internal stress shall be eliminated.

5.3.4 Power transmission components

5.3.4.1 The permissible power transmission methods for the main drive system are direct connection between the drive roller and the speed reducer, coupling drive, gear drive, and shall not be used for belt drive, chain drive, or friction wheel drive.

5.3.4.2 Couplings, universal joints, etc. in the power transmission device shall be calculated according to the full load condition.

5.3.5 Brake devices

5.3.5.1 The braking force shall be generated by a compression spring and applied mechanically.

5.3.5.2 Braking force shall be evenly distributed across the brake pads.

5.3.5.3 There shall be an allowance for brake travel, which shall compensate for brake pad wear.

5.3.5.4 The braking torque of the brake shall not be less than the braking torque required to stop the conveyor belt within 0.3 m under full load conditions, even if the brake pads are worn, the brake discs are contaminated with oil or vapor, or the brake pads and brake discs are not in uniform contact.

5.3.6 Tensioning device

5.3.6.1 Hydraulic tensioning

5.3.6.1.1 Oil pressure indicating device shall be provided.

5.3.6.1.2 The hydraulic system shall have a pressure maintaining function to keep the system pressure stable.

5.3.6.1.3 The rupture safety factor for hydraulic lines and connecting elements shall not be less than 3.

5.3.6.1.4 The hydraulic tensioning device shall be protected against low temperature freezing.

5.3.6.1.5 The elongation of the conveyor belt shall not cause the cylinder rod to reach its limit position under all load conditions.

5.3.6.2 Hammer tensioning

5.3.6.2.1 The structure of the weight shall be designed so that the weight moves up and down without derailment and jamming.

5.3.6.2.2 The weight well shall be capable of preventing snow, ice, water, and debris from accumulating under or around the weights and interfering with the movement of the weights.

5.3.6.2.3 Mechanical limits shall be used to limit the travel of the weights and should not reach the end position under normal operation.

5.3.6.2.4 When the hammer and the tensioning device are connected by steel wire rope, the steel wire rope shall be flexible and resistant to bending, and its tensile safety coefficient should not be less than 5.5.

5.3.7 Conveyor belt anti-deflection device

A conveyor belt anti-running device shall be installed at the driving device or at the returning device to automatically prevent the conveyor belt from running out of alignment.

5.4 Snow clearing and heating melting devices

5.4.1 Snow and ice scraper

5.4.1.1 The surfaces of the drive roller, guide roller and return roller shall be equipped with ice and snow scrapers to prevent the surfaces from icing and slipping.

5.4.1.2 The clearance between the snow and ice scraper and the roller surface shall be adjustable, and its adjustment stroke should not be less than 20 mm.

5.4.2 Conveyor belt automatic cleaning device

5.4.2.1 Conveyor belts shall be equipped with automatic sweeping devices for the conveyor belt at the top station (landing area), which shall automatically sweep snow or debris from the surface of the conveyor belt during its operation.

5.4.2.2 The clearance between the cleaning device and the roller surface should be adjustable, and its adjustment stroke should not be less than 20 mm.

5.4.3 Heated snow-melting devices

5.4.3.1 Heated snow melting device should be installed under the automatic sweeping device, which shall be able to heat and melt the snow swept down from the conveyor belt, and the melted water shall be able to be discharged in time.

5.4.3.2 The heater of the heated snow melting device shall be equipped with a temperature control switch, and the heat conduction medium shall be equipped with the function of liquid insufficiency alarm when liquid is used.

5.4.3.3 When a catch basin is provided, the catch basin should have a drain pipe, and the drain pipe shall be protected against low temperature freezing.

5.5 Line facilities

5.5.1 Belt

5.5.1.1 Conveyor belts shall be made of materials that are resistant to temperatures below -20°C and to abrasion.

5.5.1.2 The adhesion of the conveyor belt shall prevent skiers from slipping on the belt at the maximum slope of the conveyor belt, when the snow and ice are thawed and wet.

5.5.1.3 The effective width of the single person conveyor belt shall not be less than 0.4 m.

5.5.1.4 The conveyor belt shall be horizontal in the transverse direction and the transverse gradient shall be within $\pm 1.5\%$ ($\pm 0.86^\circ$) of the horizontal line.

5.5.1.5 Conveyor belt joints shall be made of materials that are corrosion-resistant and still have sufficient toughness and elongation at operating ambient temperatures of -20°C or lower.

5.5.1.6 The joints of the belt shall not have any gaps greater than 4 mm.

5.5.2 Rollers

5.5.2.1 Conveyor belts should be supported on the line by rollers.

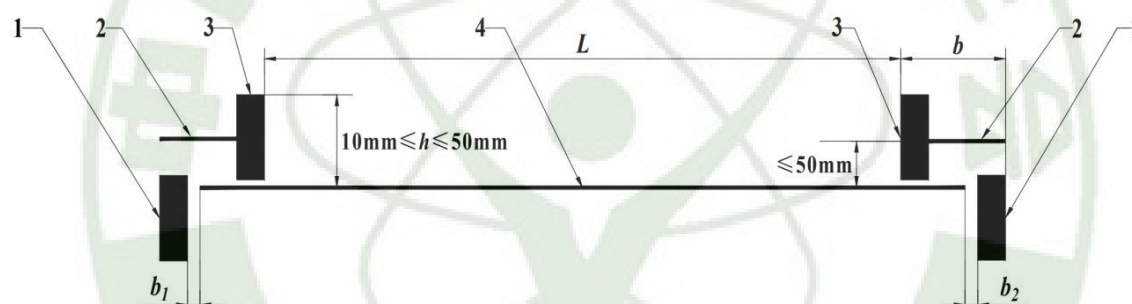
5.5.2.2 Roller shall be made of stainless steel.

5.5.2.3 Both ends of the rollers shall be designed for waterproofing, rustproofing and sealing, and the bearings shall be of maintenance-free type.

5.5.2.4 The maximum clearance between the rollers shall not be more than 40 mm.

5.5.3 Conveyor belt guidance and skier guidance

5.5.3.1 The conveyor belt shall be provided with side rails throughout its length, which shall be able to stop the conveyor belt from deflecting (as shown in Figure 4).



Description of the citation sequence: 1—conveyor belt side guide; 2—cover plate (can also be used as a guide plate for skis or boots); 3—side guide plate; 4—conveyor belt.

Figure 4 Schematic diagram of conveyor belt and its accessories

5.5.3.2 Guide plates with a height (h) of 10 mm to 50 mm shall be installed above the side of the conveyor belt (as shown in Figure 4). The guide plates shall ensure that the skis or boots worn by the skier are guided along the entire length of the carpet in a continuous, smooth and unobstructed manner from side to side.

5.5.3.3 The horizontal transverse distance (L) between the guide plates shall not be less than the designed effective width of the conveyor belt (as shown in Figure 4).

5.5.3.4 The gap between the lower edge of the guide plate and the upper surface of the conveyor belt shall not exceed 6 mm when the conveyor belt is in operation.

5.5.3.5 Vertical roller guides should be installed on both sides of the lower return conveyor belt to stop the belt from deflecting.

5.5.3.6 The spacing of the lower support rollers of the return conveyor belt shall be such that the belt does not touch the bottom support structure and the ground due to

excessive deflection under any operating conditions, as well as during startup and emergency stops.

5.5.4 Conveyor belt side protection cover

5.5.4.1 Both sides of the conveyor belt shall be fitted with protective covers that completely cover the roller ends and belt edges on both sides. The inner side of the cover may also be used as a guide plate, and shall be complies with the requirements of 5.5.3.2 (as shown in Figure 4).

5.5.4.2 The cover shall not be higher more than 50 mm above the upper surface of the conveyor belt (as shown in Figure 4).

5.5.4.3 The protective cover shall always be able to press against both edges of the conveyor belt during operation, preventing it from floating even in the event of belt runout.

5.5.4.4 The width (b) of the protective cover (shown in Figure 4) shall satisfy the calculated value of formula (2):

$$b \geq b_1 + b_2 + 20 \dots\dots\dots (2)$$

In equation:

b —width of the protective cover in millimeters (mm);

b_1 —clearance on the left side of the belt in millimeters (mm);

b_2 —clearance on the right side of the belt in mm (mm).

5.5.4.5 The protective covers on the side of the belt as well as the guide plates shall be designed to prevent skier's clothing or body parts from being caught, entangled or entangled, and the seams shall follow the direction of operation of the conveyor belt.

5.5.5 Line access paths and rack side protectors

5.5.5.1 The upper surface of the rack on both sides of the line conveyor belt shall be convenient for the staff to walk when overhauling, and the surface should be equipped with non-slip coverings.

5.5.5.2 The sides of the line racks shall be provided with barrier protectors against snow intrusion into the conveyor belt.

5.5.6 Support device

5.5.6.1 Materials

5.5.6.1.1 Line support structural elements shall be made of sedated steel to prevent the risk of brittle fracture for use in low temperature environments below -20°C .

5.5.6.1.2 Line support structural member materials should be corrosion-resistant galvanized steel.

5.5.6.2 Framework

5.5.6.2.1 The legs of the line support structure shall be provided with height adjustment.

5.5.6.2.2 The design of the bottom legs shall be calculated in the slope of the conveyor belt equipment gravity force and thermal expansion and contraction on the top station (landing area) supporting structure of the force, the bottom legs shall be designed to be installed with the horizontal plane to maintain vertical.

5.5.6.2.3 The bottom support structure of the conveyor belt shall be such that the conveyor belt shall not collapse, overturn, sway, shift, or become disconnected, even when subjected to the combined effects of the loads described in 4.2.5.2.

5.5.7 Line foundations

5.5.7.1 Line foundations should be of reinforced concrete or prestressed concrete construction.

5.5.7.2 The design of line foundation shall conform to the relevant provisions of GB 50007 and GB 50010.

5.5.7.3 The line foundation shall be capable of withstanding the loads transmitted by the bottom support under full load conditions of the conveyor belt.

5.5.7.4 The coefficient of safety of the line foundation against slip, overturning and torsion shall not be less than 1.5.

5.6 Safety device

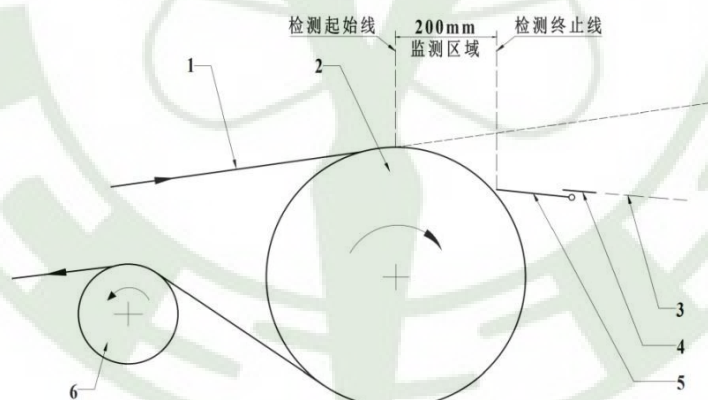
5.6.1 Protection requirements

5.6.1.1 All moving parts, except the conveyor belt carrying surface, shall be fitted with protective enclosures to prevent personnel from approaching and touching them.

5.6.1.2 Electrical components, detection switches, safety protection devices shall be shielded or waterproof, weatherproof design, the installation location should be convenient for monitoring and maintenance, in -20°C or lower temperature, snow, air humidity or rain splash and other inclement weather, their respective detection, signal transmission, operation and protection functions should be intact and effective.

5.6.2 Fall prevention monitoring device for top station (landing area)

5.6.2.1 The end of the conveyor belt in the top station (landing area) shall be equipped with a fall prevention and monitoring device capable of detecting a spherical object with a diameter of 100 mm within 200 mm of the frontmost end of the safety plate (as shown in Figure 5).



Description of the citation sequence: 1—conveyor belt; 2—drive roller; 3—snow surface; 4—landing plate; 5—safety movable plate; 6—guide roller.

Figure 5 Schematic diagram of the detection area of the fall prevention monitoring device

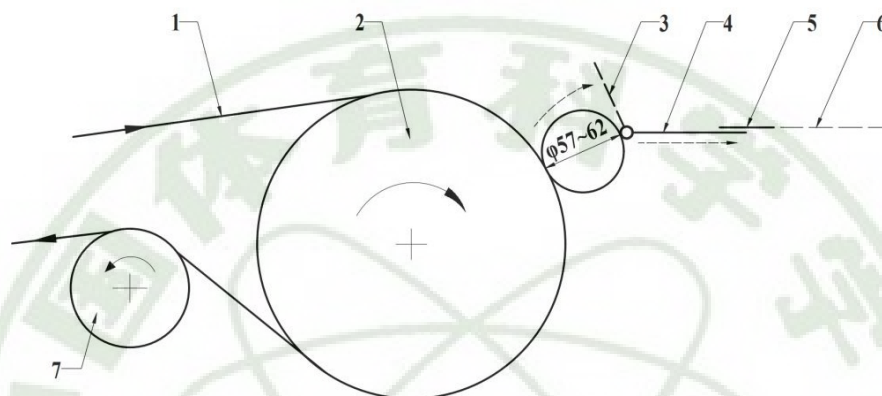
5.6.2.2 The emergency stop shall be triggered when the skier stays static for more than 3 s in the monitoring area in front of the safety plate. For conveyor belt operating at speeds up to 0.4 m/s, the dwell time may be extended to 5 s.

5.6.2.3 If optical detection devices are used, they shall not be affected by environmental changes such as lighting, sunlight, foggy weather, etc.

5.6.3 Anti-involvement monitoring device for top station (landing area)

5.6.3.1 The end of the conveyor belt of the top station (landing area) shall be equipped with anti-involvement monitoring device, when the skier's clothes or limbs are involved between the conveyor belt and the safety plate, resulting in the position of the safety plate to move or flip, it should be able to trigger an emergency stop immediately, and shall be triggered by the emergency stop when the gap between the safety plate and the conveyor belt reaches 20 mm at the latest.

5.6.3.2 The safety plate should be opened by means of a parallel moving or rotating movement to a width of 60 mm and, when fully opened, the opening shall allow the passage of a sphere with a diameter of not less than 57 mm but not more than 62 mm (as shown in Figure 6).

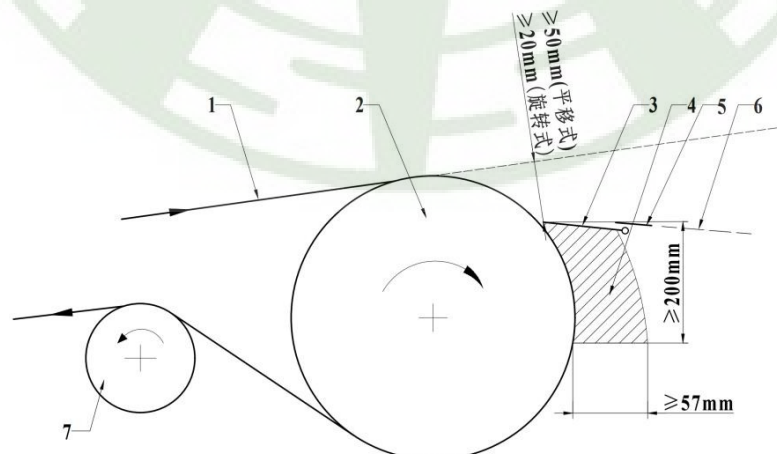


Description of the citation sequence: 1—conveyor belt; 2—drive roller; 3—safety movable plate (flap plate); 4—safety movable plate (pan plate); 5—landing plate; 6—snow surface; 7—guide roller.

Figure 6 Schematic diagram of the maximum opening of the safety plate

5.6.3.3 The edges of the safety plate shall be rounded and chamfered, and the force required to open the plate shall not be greater than 50 N.

5.6.3.4 The parallel moving safety plate shall be installed at least 50 mm below the extension of the upper surface of the conveyor belt conveyor belt, and the rotating safety plate shall be installed at least 20 mm below the extension of the upper surface of the conveyor belt conveyor belt (as shown in Figure 7).



Description of the citation sequence: 1—conveyor belt; 2—drive Roller; 3—safety activity plate; 4—free space; 5—disembarkation plate; 6—snow surface; 7—guide roller.

Figure 7 Schematic diagram of the installation position of the safety plate

5.6.3.5 In a space of at least 200 mm depth below the safety plate, a sphere with a diameter of 57 mm shall be permitted to pass while in close proximity to the conveyor belt (as shown in Figure 7).

5.6.4 Conveyor belt slip and reversal monitoring device

5.6.4.1 The conveyor belt shall be equipped with a monitoring device for slip and reversal running, which shall be capable of monitoring the conveyor belt's running speed and running direction to prevent the conveyor belt from slipping on the drive pulley and any reversal during operation and after stopping.

5.6.4.2 The drive shall be designed to prevent the belt from slipping on the drive rollers. The drive and tensioning device shall provide sufficient drive and tension to prevent belt slippage and any uncontrolled reversal of the conveyor belt under all operating conditions.

5.6.4.3 When the speed of the conveyor belt is monitored to be lower than that of the drive motor or the difference in speed of the drive pulley exceeds the limit value, a work stop shall be triggered.

5.6.4.4 When the conveyor belt is monitored for reversal, the emergency stop shall be triggered and the mechanical anti-reversal device or brake will be started automatically and immediately.

5.6.5 Inspection cover monitoring and protection

5.6.5.1 The isolated protection area of the drive and return device shall be provided with an access cover, which shall be monitored and protected so that the drive shall not be able to start or stop operation immediately when the access cover is opened.

5.6.5.2 When servicing, the access flap shall only be opened with a tool or key.

5.6.6 Stop protection for multiple consecutive lines without intermediate exits

For multiple continuous conveyor belts without intermediate exits or with intermediate exits blocked by building exits (e.g., gates, fire doors), the conveyor belts below the rear of any one of these carpets shall stop at the same time as any of them stops, and the conveyor belts above the front of these carpets shall be unaffected.

5.7 Electrical equipment

5.7.1 Fundamental requirement

5.7.1.1 Design and selection of electrical equipment

The design and selection of electrical equipment shall comply with the relevant provisions of GB/T 5226.1.

5.7.1.2 Work (normal) stop switch

The working (normal) stop switch shall be set on the control panel of the main control box and auxiliary control box, which triggers the working (normal) stop when pressed, and after stopping, the conveyor belt can only be restarted from the operating position triggered by the working stop.

5.7.1.3 Emergency stop switch

5.7.1.3.1 The emergency stop switch shall be of the red mushroom head manual reset type.

5.7.1.3.2 Emergency stop switches shall be installed in the middle of the line at the top station (landing area), the bottom station (boarding area), and in the middle of the line where the length of the line exceeds 200 meters.

5.7.1.3.3 Emergency stop switches shall be clearly marked with the words "emergency stop" on or immediately adjacent to the device.

5.7.1.3.4 Emergency stop switches shall have measures to prevent abuse or accidental touching by skiers.

5.7.1.4 Main switch

5.7.1.4.1 There shall be a main switch on the control panel on the drive or main control box. The main switch shall be capable of disconnecting power to the motor, brake release and control circuits.

5.7.1.4.2 The main switch shall be equipped with an equipment maintenance locking function, conveyor belt downtime without external operations during maintenance, the main switch shall be able to be locked in the "off" position by means of a key or other means.

5.7.1.5 Auxiliary equipment switch

When auxiliary equipment (e.g. heating devices, lighting devices) are supplied separately, they should be able to be cut off individually. Each auxiliary equipment switch shall be easy to operate and should be clearly marked.

5.7.1.6 Control box

5.7.1.6.1 Main control box

5.7.1.6.1.1 The main control box shall be mounted at the operator's position at the top station (landing area). From this position, the operator shall be able to observe the entire length of the conveyor belt and, in particular, the 100 mm diameter sphere on the safety panel.

5.7.1.6.1.2 The control panel on the main control box shall have at least the following operating and signaling indications:

- a) start and stop device;
- b) reset button;
- c) speed controller;
- d) operating parameter display;
- e) fault display.

5.7.1.6.1.3 The main control panel shall have protective isolation to prevent skiers from touching the operation.

5.7.1.6.1.4 The main control box shall be designed to be rainproof and have a protection rating of IP54.

5.7.1.6.1.5 The main control box shall be equipped with automatic thermostatic heating function, should maintain the temperature inside the box above 5°C.

5.7.1.6.2 Auxiliary control box

5.7.1.6.2.1 Other auxiliary control boxes may be installed in locations other than the area operating position, but the main control box and other auxiliary control boxes should not be valid at the same time, the conveyor belt shall not be activated at the same time from two control positions, and the control right may be designed for selection from the

main control box.

5.7.1.6.2.2 The auxiliary control box shall be mounted in a location that allows the staff to observe the full length of the conveyor belt and, in particular, shall be able to see the condition of the skiers in the area of the safety activity panels at the top station (landing area). All functions of the control panel on the auxiliary control box shall be integrated into the overall operating program.

5.7.2 Control system

5.7.2.1 Fundamental requirement

5.7.2.1.1 The electrical system shall be provided with conventional circuit protection such as over-voltage, over-current and phase failure.

5.7.2.1.2 The control system shall be able to memorize the fault, and even if the fault has been removed and the safety reset, this fault signal shall not be cleared automatically until the reset button is manually pressed.

5.7.2.2 Safety circuit

All stopping devices and safety protection devices shall form an interlocking closed safety circuit, and any signal from any device shall immediately interrupt the closed circuit and stop the machine.

5.7.2.3 Start and stop control

5.7.2.3.1 The run command shall not take effect until all conditions involving safe startup are present.

5.7.2.3.2 If the conveyor belt does not operate after 30 s of the command to start operation, the command signal shall be automatically withdrawn.

5.7.2.3.3 Start-up shall be indicated by an electric bell or a visible red warning flashing light.

5.7.2.3.4 The stop function shall negate the relevant start function, and a stop command from any control station shall be valid when the control station is more than one.

5.7.2.3.5 Any reset of a stop fault shall be manually reset on the active control panel.

5.7.2.3.6 Emergency stops or equipment failure stops initiated by the main or auxiliary control box shall have an audible alarm that continues until a manual reset is performed to eliminate it.

5.7.2.3.7 Working (normal) stop shall be smooth. Under full working conditions, the conveyor belt shall not slip after stopping.

5.7.2.3.8 It is desirable that the working (normal) stop may be made first by means of an electrical brake, which should release its full braking force when the conveyor belt is reduced to zero speed.

5.7.2.3.9 When the emergency stop is triggered, the brake shall actuate immediately, the conveyor belt shall stop within 0.3 m, and after stopping, it should remain stationary without reverse skidding even under full load conditions.

5.7.2.3.10 Activation of the emergency stop control shall not be compromised during work stops, and emergency stops shall take precedence over work stops at all times.

5.7.2.3.11 In the event of a sudden power failure of the conveyor belt or an interruption

in the power supply to the motor that prevents electrical braking, the brake shall act immediately and automatically and without reverse skidding under any load.

5.7.2.4 Safety voltage

The supply voltage for the safety circuit of the electronic control system shall be less than 25 V AC or 60 V DC.

5.7.2.5 Speed control

The operating speed shall not be affected by load variations, and changes in operating speed during operation shall not exceed the range of $\pm 5\%$ of the given speed.

5.7.2.6 Wireless control

5.7.2.6.1 When wireless technology is used to transmit signals between the auxiliary control box and the main control box, transmission reliability, immunity to interference and response time shall not affect their stop control.

5.7.2.6.2 The capability of the wireless control system to control the conveyor belt shall be such that automatic continuous monitoring can be implemented, and audible or visual warnings shall be provided in the event of degradation of the transmitted signal (e.g., reduced signal level, low battery).

5.7.2.6.3 Measures shall be taken to prevent machinery from responding to signals from control boxes that are not intended for wireless operation.

5.7.2.6.4 Reactivation of the radio-controlled auxiliary control box after loss of power, loss of communication, or component failure shall not result in resetting of the emergency stop condition.

5.7.3 Communication and signal display

5.7.3.1 Communication

5.7.3.1.1 Line announcements or hand-held amplification devices shall be provided so that skiers may be notified of the situation and the likely wait time for resumption of operation in the event of an abnormal stop of the equipment.

5.7.3.1.2 A special telephone shall be set up between the bottom station (boarding area) and the top station (landing area) or equipped with a walkie-talkie.

5.7.3.2 Signal display

5.7.3.2.1 It shall be equipped with a running timer and display the accumulated running time.

5.7.3.2.2 At least the following operating parameters shall be displayed:

- a) current;
- b) voltage;
- c) running speed.

5.7.3.2.3 At least the following fault signals shall be displayed:

- a) abnormal power supply (e.g., phase loss, overvoltage, undervoltage);
- b) emergency stop;
- c) the fall prevention monitoring device is activated;
- d) the anti-involvement monitoring device operates;
- e) conveyor belt slipping on drive roller;

- f) reverse;
- g) inspection cover movement;
- h) insufficient heat transfer fluid to heat the snow melting unit;
- i) drive abnormality (e.g., overcurrent).

5.7.4 Current protection and atmospheric discharge protection

All metal parts of the conveyor belt, the shell of the main control box shall be directly and permanently grounded installation.

6 Installation

6.1 Line foundation

6.1.1 The construction of the line foundation should be carried out in accordance with the relevant provisions of GB 51004.

6.1.2 The line foundation shall have construction records and should be completed and accepted in accordance with the relevant provisions of GB 50202.

6.1.3 The procedure and organization of line foundation completion acceptance should be carried out in accordance with the relevant provisions of GB 50300.

6.2 Basic requirements for equipment installation

6.2.1 Installation of conveyor belts shall have conveyor belt installation instructions, electrical wiring diagrams, foundation diagrams and other technical documents.

6.2.2 The installation unit shall prepare the installation construction program according to the design requirements of conveyor belt project and installation technical requirements.

6.2.3 The installer shall check the site installation conditions of the conveyor belt before installation, and if there is a risk of landslides or lateral slopes in the ground, measures shall be taken to eliminate the risk in the first place.

6.2.4 The installer shall inspect the civil foundation prior to installation and check the as-built acceptance report for the foundation.

6.2.5 The installation unit shall check and confirm the consistency of the installed equipment with the design documents before installation. The equipment shall be free from deformation, damage and corrosion.

6.2.6 Mechanical equipment that cannot prevent dust or debris from entering the moving parts during transportation and storage shall be disassembled and inspected and cleaned twice before installation, and all lubricants shall be replaced again if necessary.

6.2.7 The installation of the general parts of the mechanical equipment shall conform to the relevant requirements of GB 50231 and the technical documents of the equipment.

6.2.8 The installation of electrical equipment shall comply with the relevant requirements of DL/T 5161.5, DL/T 5161.6, DL/T 5161.8, DL/T 5161.12 and technical documents of the equipment.

6.2.9 After the installation of the conveyor belt, the installer and the manufacturer of the conveyor belt shall jointly verify and confirm the following:

- a) conformity of the assembly of protection, warning signs, control boxes to the technical documentation of the installation and to this document;

- b) conformity of the safety clearance around the conveyor belt, the safety distances of the guards, the geometry of the components to the technical documentation of the installation and to this document;
- c) proper operation of safety protection devices;
- d) proper operation of emergency stop devices, alarms, and fault displays.

6.3 Installation of drive, return and tensioning devices

6.3.1 The installation of the motor shall comply with the relevant requirements of DL/T 5161.7 and the technical documents of the equipment.

6.3.2 The installation of the speed reducer shall be in accordance with the manufacturer and the relevant requirements of GB 50231, and the grade and quantity of lubricant added shall be in accordance with the requirements of the use and maintenance instructions.

6.3.3 The following shall be checked and verified when installing the brake:

- a) flexible and reliable opening and stop;
- b) the brake pads are in full contact with the brake disk when the brake is lowered, and the gap between the brake pads and the brake disk when the brake is opened is evenly distributed and within the allowable range;
- c) there shall be an allowance for brake travel that compensates for brake pad wear.

6.3.4 When hydraulic tensioning is used, the installation of the hydraulic tensioning device shall be carried out in accordance with the relevant requirements of GB 50231. After installation, the oil pressure display value shall be consistent with the design.

6.3.5 The travel wheels of the tensioning trolley shall be in good contact with the travel track.

6.3.6 When the hammer is tensioned, the hammer can be lifted up and down freely without any jamming phenomenon, and the guide wheel can operate flexibly without abnormal noise.

6.4 Installation of line equipment

6.4.1 The projected line of the centerline of the conveyor belt on the horizontal plane after installation of the conveyor belt shall be a straight line, and the belt shall be kept straight during operation at maximum speed and shall not be pulled out of the protective cover under any circumstances.

6.4.2 Longitudinal slopes at various points along the conveyor belt shall be consistent with the slopes noted in the installation instructions.

6.4.3 After adjusting the height and horizontal level of the conveyor belt, the height adjustment device shall be tightened and effective anti-loosening measures shall be set up.

6.4.4 The bottom support of the conveyor belt and the connection between all parts should be stable, and there shall be no shaking, shifting or excessive vibration during operation.

6.4.5 Before installation, check whether the rollers are rotating flexibly and without abnormal noise, and each roller shall be in contact with the lower surface of the conveyor belt after installation.

6.4.6 The bottom legs shall be vertical to the horizontal line after installation.

7 Testing and inspection

7.1 Fundamental requirement

7.1.1 The conveyor belt shall be tested after the installation of the equipment, and the test run includes single machine (device or component) test run, no-load test run of the whole machine, and load test run of the whole machine.

7.1.2 Conveyor belt shall be put into operation and use after passing the inspection, before the first use of conveyor belt and before the annual opening of the conveyor belt, the conveyor belt operation and use of the unit shall be organized to inspect the work, the inspection should be carried out by a qualified third-party inspection agency.

7.2 Test run

7.2.1 Stand-alone (unit or component) commissioning

7.2.1.1 After the assembly of all components of the drive device is completed, before the installation of the belt, a single test run shall be carried out, and the continuous operation time under the nominal speed shall not be less than 2.5 h.

7.2.1.2 The driving device shall run smoothly, the rising temperature of the motor and reducer shell and the temperature rise of the bearings shall not exceed the provisions of the use and maintenance instructions, and the lubrication and sealing should be good, and there shall not be oil seepage.

7.2.1.3 Hydraulic tensioning device shall be pressurized and pressure relief test, rated pressure shall not be less than 1 h continuous pressurization time.

7.2.1.4 Heating snow-melting device shall be heated test, the working temperature of the heating tube shall be able to reach the design temperature, the test time shall not be less than 1 h.

7.2.2 No-load test run of the whole machine

7.2.2.1 The normal trouble-free continuous cycle running time shall not be less than 2 h under no load.

7.2.2.2 The conveyor belt shall start, run and stop smoothly without abnormal sound.

7.2.2.3 Drive roller, return roller, steering roller, line roller rotation shall be flexible, no jamming.

7.2.2.4 The belt shall not swing from side to side or favor one side of the guide during operation.

7.2.2.5 The following basic performance of the conveyor belt under no load shall be verified:

- a) the operating speed of the conveyor belt shall be in accordance with 4.1.5;
- b) working (normal) stops shall be in accordance with 5.7.2.3.7;
- c) emergency stops shall comply with 5.7.2.3.9;
- d) the deflection of the return conveyor belt during start-up and emergency stops shall be in accordance with 5.5.3.6;
- e) when hydraulic tensioning is used, the tensioning oil pressure shall be stabilized and comply with the requirements of 5.3.6.1.5; when hammer tensioning is used, it shall comply with the requirements of 5.3.6.2.1 and 5.3.6.2.3;
- f) the fall prevention and monitoring device for the top station (landing area) shall comply with the requirements of 5.6.2.1 and 5.6.2.2;

- g) the anti-involvement monitoring device for the top station (landing area) shall comply with the requirements of 5.6.3.1;
- h) conveyor belt slip and reversal monitoring devices shall comply with the requirements of 5.6.4.3 and 5.6.4.4.

7.2.3 Complete machine load test

The following performance of the conveyor belt shall be verified under full load operating conditions:

- a) the operating speed of the conveyor belt shall be in accordance with 4.1.5;
- b) start-up for full load conditions shall be in accordance with 5.3.2.1;
- c) working (normal) stops shall be in accordance with 5.7.2.3.7;
- d) emergency stops shall comply with 5.7.2.3.9;
- e) the conveyor belt shall not deflect, and the conveyor belt anti-deflection device shall be able to automatically prevent the conveyor belt from deflecting;
- f) the deflection of the return conveyor belt during start-up and emergency stops shall be in accordance with 5.5.3.6;
- g) when hydraulic tensioning is used, the tensioning oil pressure shall be stabilized and comply with the requirements of 5.3.6.1.5; when hammer tensioning is used, it shall comply with the requirements of 5.3.6.2.1 and 5.3.6.2.3;
- h) the bottom support structure of the line shall meet the requirements of 5.5.6.2.3 for startup and emergency stop under full load conditions;
- i) the line foundation shall meet the requirements of 5.5.7.3 under full load conditions.

7.3 Acceptance inspection before first operational use

7.3.1 Acceptance inspection of the conveyor belt shall be carried out at the end of the test run and before the first operational use to verify that the parameters and performance of the equipment meet the requirements of Chapter 4 to 6.

7.3.2 The manufacturer shall provide at least the following information for acceptance testing:

- a) technical drawings;
- b) use and maintenance instructions;
- c) design drawing.

7.3.3 Acceptance tests should be verified by reference to the items and methods listed in Table A.1 of Appendix A.

8 Operations and maintenance

8.1 Fundamental requirement

8.1.1 The use and maintenance instructions shall include at least the following:

- a) equipment structure components;
- b) technical performance and parameters;
- c) scope of application and environmental conditions of use;
- d) settings and adjustments;
- e) operating instructions;
- f) items and cycles of monitoring, inspection, and testing;
- g) location of all lubrication points, lubricant replacement intervals, and the quality and labeling of the lubricant to be used;

- h) catalog of regularly replaced parts, including variety, quantity, and periodicity of replacement;
- i) maintenance and tuning contents and intervals for moving parts;
- j) gap to be observed;
- k) conveyor belt deterioration inspection cycle and its repair instructions;
- l) troubleshooting, identification and treatment of faults;
- m) overhaul time for electromechanical equipment such as motors, gearboxes, drive rollers, etc;
- n) recommended life of critical parts and equipment;
- o) decommissioning, storage, removal and dismantling;
- p) operator and maintenance staffing;
- q) emergency situations (e.g., sudden shutdowns or accidents) are handled;
- r) advice on protection from wind and rain.

8.1.2 The operation use and maintenance of the conveyor belt by the operation and use unit shall be carried out in accordance with the requirements of the use and maintenance instructions.

8.2 Staffs

8.2.1 Conveyor belt managers

8.2.1.1 The operation and use of conveyor belts shall be managed with safety management personnel responsible for the management of conveyor belts, and assume the corresponding management responsibilities.

8.2.1.2 The safety manager shall be responsible for the development and implementation of the following management systems:

- a) conveyor belt duties for each position;
- b) safe operating procedures;
- c) a system of daily inspections;
- d) maintenance system;
- e) training and assessment system for operators and maintenance personnel;
- f) emergency rescue plan for accidents or incidents;
- g) safety technical file management system.

8.2.1.3 The safety manager shall be responsible for developing the following operational measures:

- a) measures on how to troubleshoot equipment when abnormalities or malfunctions are detected;
- b) measures for checking and eliminating and re-running the conveyor belt when it stops due to the operation of the safety protection device;
- c) handling of stops when severe weather conditions threaten operational safety;
- d) operational measures in case of insufficient visibility;
- e) measures for nighttime operation;
- f) measures to remove ice and snow from conveyor belt surfaces or mechanical parts;
- g) the conditions under which, and the method by which, the duties of the top and bottom station operators or attendants are transferred to other staff members in the event of their temporary departure.

8.2.2 Conveyor belt operators and maintenance personnel

8.2.2.1 Conveyor belt operators shall be trained and familiar with the construction and technical performance of the components of the conveyor belt and be capable of responding to any stop and fault alarms and taking the necessary measures.

8.2.2.2 Maintenance personnel shall be authorized personnel and should be trained and qualified before carrying out maintenance work on conveyor belts.

8.2.2.3 Maintenance personnel shall be familiar with the structural principles and maintenance methods of each part of the conveyor belt.

8.2.2.4 At least one operator shall be on duty at each of the top and bottom stations when the conveyor belt is in operation.

8.2.2.5 If an emergency occurs during operation, the operator shall quickly press the emergency stop switch.

8.2.2.6 Operators shall discourage the act of riding the conveyor belt without the spacing requirements to prevent overloading the carpet.

8.3 Documentation

8.3.1 The operation and use of conveyor belts shall establish safety files. The safety file shall include at least, but not limited to, the following contents:

- a) technical drawings;
- b) certificate of conformity for the whole machine;
- c) use and maintenance instructions;
- d) completion and acceptance report for foundation work;
- e) inspection report;
- f) equipment repair and replacement records;
- g) records of equipment operational failures and accidents;
- h) personnel training and assessment records;
- i) daily use conditions and maintenance records;
- j) regularly check maintenance records.

8.3.2 A person shall be appointed to keep the safety technical file, and any technical modifications to the equipment shall be explained in the archive information on the changes.

8.3.3 It should be to create digital files.

8.4 Operation

8.4.1 Basic requirement

8.4.1.1 Conveyor belts shall not be used for tasks other than those for which they were designed, and they shall not to be operated under abnormal operating conditions.

8.4.1.2 Conveyor belt operators and users shall not arbitrarily change the location of the bottom station (boarding area) and top station (landing area), the inclination angle of the boarding and landing plates, increase the conveying capacity, or make other changes that affect the performance of the equipment.

8.4.1.3 All start-up operations shall be performed by trained operators.

8.4.1.4 Before the conveyor belt is shut down for more than one month and re-run, all mechanical and electrical equipment shall be inspected, adjusted and tested to make sure they are normal before running.

8.4.1.5 Safety scissors, safety knives, and other safety emergency response tools shall be available and properly stored.

8.4.1.6 When the conveyor belt is in operation, only skiers wearing ski gear, ski boots and possibly carrying ski equipment is permissible to be transported and the skiers shall be spaced on the conveyor belt in accordance with the manufacturer's specifications.

8.4.1.7 The operation and use of conveyor belts shall take measures to prevent, eliminate or reduce the risks. A list of significant risks of conveyor belts is shown in Table B.1 in Appendix B.

8.4.2 Pre-operational requirements

8.4.2.1 Before starting operation each day, the operator shall check and verify at least the following items:

- a) the supply voltage is normal;
- b) the hydraulic tensioning pressure gauge shows a normal value;
- c) tensioning devices (weights, cylinders, tensioning trolleys) are within normal travel range;
- d) the heat transfer fluid in the heated snow melting unit is above the normal level indicator mark;
- e) each warning sign is clearly visible;
- f) snow and ice have been removed from the surface of the conveyor belt;
- g) snow, water and frozen ice have been cleared from the interior of the drive and return;
- h) conveyor belt sweeps are not frozen or jammed;
- i) heated snow-melting unit's catch basin and drain are not frozen;
- j) the surface of the fall prevention monitoring optical detection device is free of snow and ice;
- k) the belts and joints are free from cracking and deformation;
- l) the covers at the top station (landing area) and bottom station (boarding area) were securely installed and did not appear to be moving;
- m) the boarding and landing area is clear, the conveyor belt is free of debris, and there are no people working around the conveyor belt;
- n) communications equipment is intact.

8.4.2.2 Prior to beginning operation each day, the operator shall perform at least the following items:

- a) all buttons and indicator lights are functionally tested;
- b) all emergency stop switches are tested to see if they are flexible and can stop the conveyor belt immediately when pressed;
- c) functional test of fall prevention monitoring device and anti-involvement monitoring device;
- d) braking reliability test;
- e) power on and run the test, the conveyor belt at least one cycle, to see whether the motor running smoothly, there is no abnormal noise;
- f) check the conveyor belt for slipping, deflection, scraping during the full line running test, and whether it runs straight along the center line during the running.

8.4.2.3 For the conveyor belt which has not been operated for a long time, it shall be put into operation again only after a comprehensive inspection and commissioning pass.

8.4.3 Requirements in operation

8.4.3.1 Various signal indicators on the control panel shall be normal, if abnormalities shall be identified in a timely manner.

8.4.3.2 Electromechanical equipment shall operate without abnormal noise or abnormal temperature rise of the enclosure.

8.4.3.3 If an emergency stop occurs in the conveyor belt, the cause shall be identified and effective measures shall be taken to eliminate the fault before starting again.

8.4.3.4 The main control box and auxiliary control box cabinet doors shall be locked.

8.4.3.5 The belt shall be adjusted when it swings to one side or to the left or right.

8.4.4 Post-decommissioning requirements

8.4.4.1 The conveyor belt is in a stopped, disconnected state before cleaning the inside of the conveyor belt at the bottom station (boarding area) and the top station (landing area), at which time the main switch shall be locked in the disconnected position.

8.4.4.2 During snowmaking, it should be covered the conveyor belt with waterproof material.

8.4.5 Requirements for nighttime operation

8.4.5.1 The boarding and landing areas of the conveyor belt and the entire line shall be illuminated during nighttime operation.

8.4.5.2 Lighting fixtures shall be illuminated in such a manner that skiers can see signs and markings, the floor of the boarding and landing area, the operating conveyor belt, and staff shall be able to see the control box and skiers on the conveyor belt.

8.5 Maintenance

8.5.1 Regular inspection and maintenance

The operating user shall establish a maintenance schedule and periodic inspection schedule for each conveyor belt in accordance with the manufacturer's instructions for use and maintenance provided by the manufacturer. Each month, emphasis shall be placed on checking and confirming each of the following:

- a) safety guards and guardrails shall be securely fastened;
- b) tension moving trolley guideway surface shall be clean and free of debris to impede travel;
- c) hydraulic tensioning system oil pressure shall be normal, piping shall be free of leakage;
- d) the boarding plate, landing plate, safety activity plate, line side guide plate and cover plate shall be free of warping and deformation, foreign matter protruding, cracking and screws fastening.
- e) the drive, return, and line's anti-conveyor belt runout device shall operate properly and wear should not exceed limits;
- f) conveyor belt joints shall be firmly connected, without detachment, pulling deformation or stretch over the limit;
- g) the clearance between the safety movable plate and the conveyor belt shall be normal;
- h) brake action and brake pad wear shall be normal;
- i) safety detection devices should be securely fixed, spacing from the monitored object should be normal, and switch wiring shall be free of deterioration and looseness;
- j) the rotation of the slave guide pulley and along-line rollers in the drive and return unit shall be normal;

- k) the lower supporting structure of the conveyor belt shall be firmly fixed, without deflection, displacement, deformation, loosening, and the foundation of the supporting point should be free of settlement and collapse;
- l) the straightness of the equipment in the middle section of the line shall meet the requirements, and there is no overall deformation or looseness in the joints;
- m) the bottom legs and the horizontal plane shall be kept vertical;
- n) the surface of the conveyor belt shall be free of tears and cracks;
- o) the clearance between the conveyor belt cleaning device, ice scraper and roller shall meet the requirements;
- p) heated snow-melting devices should be free of damage and liquids shall be free of leaks;
- q) safety protection devices shall be calibrated and tested properly;
- r) the speed reducer shall be free of leakage and the lubricant quantity shall meet the requirements;
- s) dimensions of equipment or work areas and clearances for adjacent equipment shall be in accordance with this document;
- t) the main control box and auxiliary control box shall be free of damage, deformation, aging and loose electrical components, terminals and wires.

8.5.2 Inspection of maintenance records

8.5.2.1 Operations of inspection, adjustment, maintenance, repair, and replacement shall be recorded in the periodic inspection and maintenance files.

8.5.2.2 Records shall be archived for a period of not less than 2 years.

9 Signs

9.1 Basic requirement

9.1.1 Signs shall be placed in a conspicuous location.

9.1.2 Signage shall be made of sturdy and durable materials with lettering and colors that can be adapted to the environmental conditions of the ski area without being damaged.

9.1.3 The size of the signage and the height at which it is set up shall comply with the provisions of GB 2894.

9.1.4 Auxiliary signs in Chinese and English characters conforming to the provisions of GB 2894 should be set below the sign on the signboard.

9.1.5 According to the needs, you may choose to use other signs stipulated in GB 2894, or refer to the provisions of GB/T 2893.1 and GB/T 2893.3 to design the signs.

9.2 Product identification

9.2.1 Conveyor belts shall have clear, permanent product identification (nameplate) affixed in a visible and appropriate location.

9.2.2 The product identification(nameplate) shall include at least the following information:

- a) product name;
- b) model or factory number;
- c) main technical parameters;
- d) full name and address of manufacturer;

e) date of manufacture.

9.3 Safety signs

9.3.1 Safety signs conveying relevant information to skiers traveling on the conveyor belt shall include, at a minimum, instruction signs and prohibition signs.

9.3.2 There shall be clear, easy-to-understand signage to give skiers safety tips for the following behaviors:

- a) the act of disembarking from the bottom station (boarding area) to enter the conveyor belt;
- b) ridership behavior during normal operation;
- c) ride behavior during shutdown during operation;
- d) the act of leaving the conveyor belt at the top station (landing area).

9.3.3 During maintenance, repair, inspection or similar work, the bottom station (boarding area) and top station (landing area) shall be equipped with suitable devices to prevent unauthorized personnel from entering and marked with the words “equipment maintenance, no approach” .

9.3.4 The safety marking should comply with GB/T 40232 and BS EN 15700.

9.4 Passenger Information

At a minimum, passenger notices shall be placed near the bottom station (boarding area) including, but not limited to, the following:

- a) unsuitable groups for passenger use;
- b) children and other special people are accompanied by an adult;
- c) requirements for wearing and holding snow gear;
- d) check and organize long hair as well as scarves, gloves, snow poles and other items before riding the conveyor belt to prevent them from getting caught in the conveyor belt;
- e) line up in order, forced queue cutting is strictly prohibited;
- f) requirements for prolonged stay at the bottom station (boarding area) are prohibited;
- g) requirements for personnel standing to maintain safe spacing;
- h) shall not walk, run, lie, prone, squat, sit, etc. on the conveyor belt;
- i) shall not smoke, play or litter during the ride;
- j) shall not jump off or climb the conveyor belt without authorization in the middle of the ride;
- k) emergency treatment in the event of a fall or caught clothing;
- l) the requirement to lift your poles and leave in a timely manner when you reach the top station (landing area);
- m) conditions for use and disabling of the emergency stop button;
- n) the requirement that the various switches and buttons in the operation box shall not be touched privately.

Annex A
(informative)

Acceptance test items and validation methods

Acceptance inspection items and verification methods are listed in Table A.1.

Table A.1 Acceptance inspection items and verification methods

Serial number	Items	Clause	Inspection methods				
			Test	Measure	Calculate	Check document	Visual assessment
1	Planning, design and calculation of lines	4					
1.1	Maximum gradient of the line	4.1.2.1		×			
1.2	Slope difference	4.1.2.2		×			
1.3	Free lateral headroom	4.1.3.1		×			×
1.4	Ground clearance	4.1.3.2		×			
1.5	Free headroom and ceiling above	4.1.3.3		×			×
1.6	Installation of electrical controls along the line	4.1.3.4					×
1.7	Safety nets or snow walls	4.1.4.1		×			×
1.8	Parallel conveyor belt clearance	4.1.4.2		×			
1.9	Running speed	4.1.5.1		×			
1.10	Speed of transportation of children	4.1.5.2		×			
2	Facilities and equipment	5					
2.1	Board mounting	5.2.1.1		×			
2.2	Board height from the ground	5.2.1.2		×			
2.3	Bottom station (boarding area) conveyor belt slope degree (angles, temperature etc)	5.2.1.3		×			
2.4	Clearance between upper board and conveyor belt	5.2.1.4		×			
2.5	Top station (landing area) last leg loss feed belt slope	5.2.2.1		×			
2.6	Top station (landing area) second to last segment slope	5.2.2.2		×			

Table A.1 (Continued)

Serial number	Items	Clause	Inspection methods				
			Test	Measure	Calculate	Check document	Visual assessment
2.7	Dismounting gradient	5.2.2.3		×			
2.8	Width of safety activity plate and landing plate			×			
2.9	Length of safety activity plate and landing plate	5.2.2.4		×			
2.10	Height of the lower plate from the ground			×			
2.11	Clearance between safety plate and conveyor belt	5.2.2.5		×			
2.12	Clearance between the lower plate and the safety plate			×			
2.13	Full load startup	5.3.2.1	×				
2.14	Drive roller surface material	5.3.3.1					×
2.15	Hop-up (landing area) roller diameter	5.3.3.2		×			
2.16	Brake performance	5.3.5.1 5.3.5.2 5.3.5.3	×				×
2.17	Hydraulic tensioning pressure display	5.3.6.1.1					×
2.18	Hydraulic tensioning and pressure maintaining function	5.3.6.1.2					×
2.19	Hydraulic tensioning measures against freezing	5.3.6.1.4				×	×
2.20	Cylinder rod position	5.3.6.1.5	×				
2.21	The weight moves up and down	5.3.6.2.1	×				
2.22	Hammer derrick	5.3.6.2.2					×
2.23	Weight Position	5.3.6.2.3	×				×
2.24	Conveyor belt anti deflection Device	5.3.7					×
2.25	Snow and ice scraper	5.4.1.1					
2.26	Conveyor belt automatic cleaning device	5.4.2.1 5.4.2.2	×	×			×
2.27	Heated snow-melting device setup	5.4.3.1	×				×
2.28	Heated snow melting unit heaters	5.4.3.2	×				×
2.29	Heated snow-melting unit catchment tanks	5.4.3.3				×	×
2.30	Anti-slip conveyor belt surface	5.5.1.2	×				

Table A.1 (Continued)

Serial number	Items	Clause	Inspection methods				
			Test	Measure	Calculate	Check document	Visual assessment
2.31	Effective width of single conveyor belt	5.5.1.3		×			
2.32	Conveyor belt transverse slope	5.5.1.4		×			
2.33	Conveyor belt joint gap	5.5.1.6		×			
2.34	Roller material	5.5.2.2				×	×
2.35	Roller bearings	5.5.2.3				×	×
2.36	Roller clearance	5.5.2.4		×			
2.37	Conveyor belt side guides	5.5.3.1					×
2.38	Conveyor belt side guide plate height	5.5.3.2		×			×
2.39	Lateral distance of the guide plate	5.5.3.3		×			
2.40	Guide plate and belt clearance	5.5.3.4		×			
2.41	Return belt guide	5.5.3.5					×
2.42	Return belt deflection	5.5.3.6	×				
2.43	Conveyor belt side protection cover performance	5.5.4.1 5.5.4.3 5.5.4.5	×				×
2.44	Protective cover height	5.5.4.2		×			
2.45	Protective cover width	5.5.4.4		×	×		
2.46	Line maintenance right-of-way	5.5.5.1					×
2.47	Rack side protective Cover	5.5.5.2					×
2.48	Line support structure	5.5.6.1.2 5.5.6.2.1 5.5.6.2.3	×			×	×
2.49	Line foundation carrying capacity	5.5.7.3	×				
2.50	Protective isolation of moving parts	5.6.1.1					×
2.51	Fall prevention monitor for boarding (landing area) sue	5.6.2.1 5.6.2.2	×	×			
2.52	Supervision of anti-involvement in up-station (down-station) areas controlled trigger	5.6.3.1	×	×			
2.53	Opening width of safety plate	5.6.3.2 5.6.3.5	×	×			

Table A.1 (Continued)

Serial number	Items	Clause	Inspection methods				
			Test	Measure	Calculate	Check document	Visual assessment
2.54	Maximum opening force of the safety activity plate	5.6.3.3	×	×			×
2.55	Safety activity plate installation location	5.6.3.4		×			
2.56	Conveyor belt slip and reversal monitoring	5.6.4.3 5.6.4.4	×				
2.57	inspection cover monitoring	5.6.5.1 5.6.5.2	×				
2.58	Multiple continuous no intermediate exit protection	5.6.6	×				
2.59	Work (normal) stop switch	5.7.1.2	×				×
2.60	Emergency stop switch	5.7.1.3.1 5.7.1.3.2 5.7.1.3.3 5.7.1.3.4	×				×
2.61	main switch	5.7.1.4.1 5.7.1.4.2	×				×
2.62	Auxiliary equipment switch	5.7.1.5	×				×
2.63	Main control box installation	5.7.1.6.1.1 5.7.1.6.1.3					×
2.64	Main control box panel function	5.7.1.6.1.2	×				×
2.65	Thermostatic heating of the main control box	5.7.1.6.1.5	×				
2.66	Auxiliary control box	5.7.1.6.2.1 5.7.1.6.2.2	×				×
2.67	Control system general circuit protection	5.7.2.1.1	×				
2.68	Control system fault memory function	5.7.2.1.2	×				

Table A.1 (Continued)

Serial number	Items	Clause	Inspection methods				
			Test	Measure	Calculate	Check document	Visual assessment
2.69	Activate bell or warning light	5.7.2.3.3	×				
2.70	fault reset	5.7.2.3.5	×				
2.71	Emergency stop alarm	5.7.2.3.6	×				
2.72	Working (normal) stop	5.7.2.3.7 5.7.2.3.8	×				×
2.73	Emergency stop	5.7.2.3.9	×	×			×
2.74	Brown-out brake	5.7.2.3.11	×				×
2.75	Safe voltage for electronic control systems	5.7.2.4		×			
2.76	Line broadcast or loudspeaker	5.7.3.1.1	×				
2.77	Telephone or intercom	5.7.3.1.2	×				
2.78	Run timer	5.7.3.2.1					×
2.79	Operation indication signal	5.7.3.2.2 5.7.3.2.3					×
2.80	Grounding	5.7.4					×
3	Mounting	6					
3.1	Tensioning trolley travel wheels	6.3.5					×
3.2	Hammer guide wheel	6.3.6					×
3.3	Conveyor belt operation	6.4.1	×				
3.4	Bottom leg adjustment for anti-loosening	6.4.3					×
3.5	Line equipment connection	6.4.4	×				×
3.6	Roller rotation	6.4.5	×				×
3.7	Bottom leg mounted vertically	6.4.6		×			
Note: The symbol "×" in the table indicates the corresponding verification method.							

Annex B
(informative)
Significant risk inventory

A list of significant risks to the conveyor belt is shown in Table B.1.

Table B.1 Conveyor belt significant risk list

Risk name	Location	Risk content
1. Falling	Belt	The skier himself/herself fails to stand still or slips and falls onto or off the conveyor belt
		Falls due to changes in the speed of the conveyor belt or the difference in speed between the skier and the belt
		Unexpected activation of the conveyor belt causing the skier to fall
		Conveyor Belt reverses causing skier to roll
		Sudden gusts of wind blowing directly down or dancing of conveyor belts causing skiers to fall without standing still
		Skier accidentally touched the emergency stop button, the Conveyor Belt suddenly stopped causing the skier to fall down
		Excessive gradient or difference in gradient causing the skier to fall without standing still
		Accidental destabilization or collapse of the conveyor belt causing the skier to fall.
	Conveyor belt breaks causing skier to roll	
	Boarding and landing plates	Crowding in the bottom station (boarding area), being pushed over and falling down
Insufficient lighting at the bottom station (boarding area) or top station (landing area) during nighttime operation, resulting in skiers stepping out and falling down.		
Boarding plate breaks, causing skier to fall into the return roll frame		
2. Collision (impact)	Conveyor belt bottom Station (boarding area), top station (landing area)	Congestion causes skiers to collide with each other
		Collision with other skiers or hard surfaces after a fall on slippery surface.
	Belt	Impacted by other skier's ski equipment, poles
		Injury caused by collision with other skiers in front of or behind you, or by collision with skiing equipment.
		High winds or emergency stops causing people to hit each other
Bottom station (boarding area), top station (landing area), along the line	Collision with obstacles around the conveyor belt (e.g., control box)	
3. Squeeze	Belt	Skiers crushing each other on the conveyor belt as they roll down the road
		Skier's limbs and head fall underneath the safety plate and are crushed

Table B.1 (Continued)

Risk name	Location	Risk content
4. Entanglement	Line skier guide plate	Skier's clothing entangled in guide plate rips
5. Involvement	Line skier guide plate	Skier's scarf, gloves, clothing caught between conveyor belt and side guide plate
	Safety Activity Board	Due to excessive clearance between the conveyor belt and the safety activity plate or the skier's failure to organize the scarf, Gloves, clothing, poles, hair, etc., cause skiers to become involved in the
6. Stabbing (cutting)	Bottom station (boarding area)	High winds knock down signage, sting skiers
	Line covers and skier guide plates	Skier falls and is stabbed by sharp projections
7. Friction (shear)	belt	Skier falls and is dragged by conveyor belt
	Line skier guide plate	Child skier's fingers between conveyor belt and side guide plate
8. Electroshock	drive unit	Contact with energized parts during inspection and maintenance by operating or maintenance personnel
9. Scalding	Heated snow-melting devices	Heating parts such as heating tubes are touched by operators or maintenance personnel during inspection and maintenance

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