

Risk Assessment Report of ROUGH TERRAIN FORKLIFT TRUCK

Report Number: MD-Q20253006-06

Applicant: Lingong Heavy Machinery Co., Ltd.

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Assessment standard: EN ISO 3691-1:2015+A1:2020, EN 16307-1:2020, EN 1175:2020,

EN 12895:2015+A1:2019, EN ISO 12100:2010

Date of issue: 19/05/2025



MANUFACTURER DETAILS

Manufacturer's name	Lingong Heavy Machinery Co., Ltd.
Manufacturer's address	2676 Kejia Road, Jinan High-tech Zone, Jinan, Shandong, P.R. China
Machine name	ROUGH TERRAIN FORKLIFT TRUCK
Machine model	F25

1. Introduction

This risk assessment report was carried out in accordance with the requirements of Machinery Directive 2006/42/EC, EN ISO 12100:2010 and ISO/TR 14121-2:2012 in which an explicit risk level is evaluated with 4 factors S-F-O-A described in next clause.

After the first assessment, some measures to eliminate the risks are given for the modification of machine or of relative documents with taking into account the explicit C-type EN standard (for ROUGH TERRAIN FORKLIFT TRUCK with engine see EN ISO 3691-1:2015+A1:2020 Table A.1, EN 16307-1:2020, EN 1175:2020, EN 12895:2015+A1:2019, EN ISO 12100:2010) or related B-type standard. While taking appropriate provisions for the existing risks, the procedures and principles to eliminate the risk are followed:

- First step: consider the possibility of eliminating risk at design stage.
- Second step: if impossible, protect the dangerous zone with appropriate design of safety guard or safety device.
- Third step: if above impossible, give warning signs to draw attention of operators about the residual risks.

In addition, the check list drawn from the explicit C-type EN standards (for ROUGH TERRAIN FORKLIFT TRUCK with engine see EN ISO 3691-1:2015+A1:2020 Table A.1, EN 16307-1:2020, EN 1175:2020, EN 12895:2015+A1:2019, EN ISO 12100:2010), which are found suitable for or near the characteristic of this machine, are used to help developing the provisions for the elimination of the risks.

Finally the risk assessment was carried out again to ensure this machine and its relative documents are totally compliance with the Machinery Directive 2006/42/EC.

2. Risk assessment methodology

The risk assessment is based on the method recommended in EN ISO 12100:2010 and ISO/TR 14121-2:2012, in which the 4 factors S-F-O-A are used to evaluate the level of risk. The meanings of those are described in the following:

(1) S: Severity of harm

S1: slight injury (normally reversible), for example, scratches(划伤), laceration(割伤), bruising(撞伤), light wound (轻伤)(requiring first aid).

S2: serious injury (normally irreversible, include fatality), for example, broken(折断) or torn-out(撕破) or crushed (压碎) limbs, fractures(骨折), serious injuries requiring stitches(缝合), major musculoskeletal troubles (肌肉骨骼疾病,MST), fatalities(死亡).

(2) F: Frequency and/or duration of exposure to hazard

F1: twice or less per work shift or less than 15 min cumulated exposure per work shift.

F2: more than twice or more than 15 min cumulated exposure per work shift.

(3) O: Possibilities of occurrence of the hazardous event

O1: mature technology, proven and recognized in safety application; robustness(有效性).

O2: technical failure observed in the two last years:

- inappropriate human action by a well-trained person aware of the risks and having more than six months experience on work station.

O3: technical failure regularly observed (every six months or less):

- inappropriate human action by an untrained person having less than six months experience on work station;
- similar accident observed in the plant in the preceding ten years.

(4) A: Possibility of avoidance or reduction of harm

A1: possible under some conditions:

- if parts move at speed less than 0.25 m/s

AND the exposed worker is familiar with the risk and with the indications of a hazardous situation or impending

hazardous event;

- depending on particular conditions (temperature, noise, ergonomics, etc.)

A2: impossible

The decision for the level of risk could be made in according to figure 1 or figure 2.

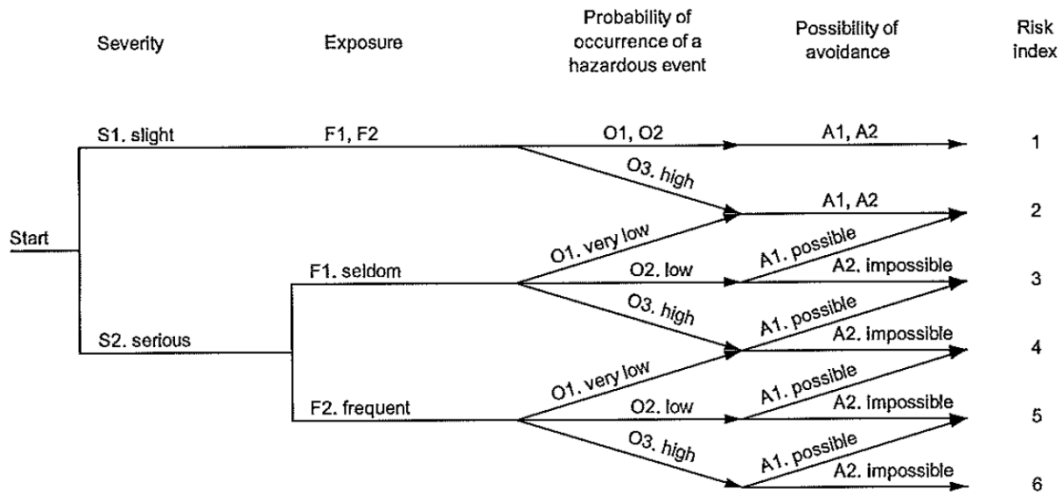


Figure 1— Risk graph for risk estimation

		Risk index calculation					
		O1		O2		O3	
		A1	A2	A1	A2	A1	A2
S1	F1	1		2			
	F2						
S2	F1	2		3		4	
	F2	3	4	5		6	

Figure 2— Equivalent risk matrix (equivalent to risk graph of figure 1)

A form is filled in with the result of the first risk assessment; each hazardous situation is allocated a risk index.

The estimation of each hazardous situation is made with consideration given to the following:

- a risk index of 1 or 2 corresponds to the lowest priority of action (priority 3);
- a risk index of 3 or 4 corresponds to a medium priority of action (priority 2);
- and a risk index of 5 or 6 corresponds to the highest priority of action (priority 1).

Possible means of reducing risk are considered and risk is then for the final design using the same risk graph in the same manner as for the initial design. A risk index of 2 or less has been evaluated as representing the level at which no further risk reduction is required

3. Technical Information

Model		F25
Rated Capacity	kg	2500
Load Center	mm	500
Lift Height	mm	3400
Max. Lifting Height	mm	3400
Turning Radius	mm	3512
Wheelbase	mm	1900
Hydraulic system working pressure	MPa	18
Travel Speed (Laden /Unladen)	km/h	12/24
Lifting Speed (Laden /Unladen)	m/s	0.47/0.50
Engine Rated Power/Speed	kW/rpm	36/2600
Overall Dimension (L×W×H)	mm	4260×1495×1975
Service Weight	kg	4350

4. Risk assessment and risk reduction

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
1.0	Mechanical Hazards due to:							See below
	-machine part or workpieces, e.g.:							---
	a. shape,							---
	b. relative location,							---
	c. mass and stability,							---
	d. mass and velocity,							---
	e. inadequacy of mechanical strength							---
	-accumulation of energy inside the machinery, e.g.							---
	f. elastic elements							---
	g. liquids and gases under pressure							---
	h. the effect of vacuum							---
1.1	Crushing hazard	Transportation and installation	Moderate	Seldom	Unlikely	possible	Very low	Safety requirement for transportation and installation provided in the user manual
		Lifting and tilting	Moderate	Seldom	Unlikely	possible	Very low	Safety requirement for operation provided in the user manual
		Stability	Moderate	Seldom	Unlikely	possible	Very low	The truck is enough stability and comply with stability requirement
		Engine cover	Moderate	Seldom	Unlikely	possible	Very low	Gas springs provided for engine cover
1.2	Shearing hazard	Lifting and lowering	Moderate	Seldom	Unlikely	possible	Very low	Warning labels provided to avoid the hazards
1.3	Cutting or severing hazard	Edges or angles	Minor	Seldom	Unlikely	possible	Very low	Smooth surface, edges or angles are constructed by manufacturer
1.4	Entanglement hazard	None	N/A	Seldom	Unlikely	possible	No	
1.5	Drawing-in or trapping hazard	None	N/A	Seldom	Unlikely	possible	No	

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
1.6	Impact hazard	Moving of the truck	Moderate	Seldom	Unlikely	possible	Very low	The rear reflex reflector and audio warning device provided for moving backward; brakes provided for parking or moving.
1.7	Stabbing or puncture hazard	None	N/A	Seldom	Unlikely	possible	No	
1.8	Friction or abrasion hazard	None	N/A	Seldom	Unlikely	possible	No	
1.9	High pressure fluid injection or ejection hazard	Hydraulic system	Moderate	Seldom	Unlikely	possible	Very low	3 times pressure used for hydraulic system, no hazards
2.0	Electrical hazards due to:							See below
2.1	Contact of persons with live parts (direct contact)						Very low	See EN 1175
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)						Very low	See EN 1175
2.3	Approach to live parts under high voltage						Very low	See EN 1175
2.4	Electrostatic phenomena						Very low	See EN 1175
2.5	Thermal radiation of other phenomena such as the projection of molten particles, and chemical effects from short-circuits, overloads; etc.						Very low	See EN 1175
3.0	Thermal hazards resulting in:							See below
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	None	N/A	Seldom	Unlikely	possible	No	
3.2	Damage to health by hot or cold work environment	None	N/A	Seldom	Unlikely	possible	No	Environment requirements indicated in user's instruction, no hazards.
4.0	Hazard generated by noise, resulting in:							See below

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	Noise	Minor	Seldom	Unlikely	possible	Very low	See the noise report
4.2	Interference with speech communication, acoustic signals, etc.	None	N/A	Seldom	Unlikely	possible	No	
5.0	Hazards generated by vibration							See below
5.1	Use of hand-held machines resulting in a variety of neurological and vascular disorders	None	N/A	Seldom	Unlikely	possible	No	
5.2	Whole body vibration, particularly when combined with poor postures	None	N/A	Seldom	Unlikely	possible	No	
6.0	Hazard generated by radiation							
6.1	Low frequency, radio frequency radiation, microwaves	N/A						
6.2	Infrared, visible and ultraviolet	N/A	N/A	Seldom	Unlikely	possible	No	No infrared, visible and ultraviolet
6.3	X and gamma rays	N/A	N/A	Seldom	Unlikely	possible	No	No X and gamma rays
6.4	Alpha, beta rays, electron or ion beams, neutrons	N/A	N/A	Seldom	Unlikely	possible	No	No Alpha, beta ray, electron or ion beam, neutron
6.5	Lasers	N/A	N/A	Seldom	Unlikely	possible	No	No such hazards
7.0	Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery	None	N/A	Seldom	Unlikely	possible	No	See below
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	None	N/A	Seldom	Unlikely	possible	No	
7.2	Fire or explosion hazard	None	N/A	Seldom	Unlikely	possible	No	
7.3	Biological and microbiological (viral or bacterial) hazards	None	N/A	Seldom	Unlikely	possible	No	

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
8.0	Hazards generated by neglecting ergonomic principals in machinery designs, e.g. hazards from:							
8.1	Unhealthy postures or excessive effort	None	N/A	Seldom	Unlikely	possible	No	Professional equipment designed for operation
8.2	Inadequate consideration of hand - arm or foot-leg anatomy	None	N/A	Seldom	Unlikely	possible	No	
8.3	Neglected use of personal protection equipment	None	N/A	Seldom	Unlikely	possible	No	Hard hat is required in user manual
8.4	Inadequate local lighting	None	N/A	Seldom	Unlikely	possible	No	
8.5	Mental overload or underload, stress	None	N/A	Seldom	Unlikely	possible	No	
8.6	Human error, human behavior	None	N/A	Seldom	Unlikely	possible	No	Require that operated by professional operator
8.7	Inadequate design, location or identification of manual controls	None	N/A	Seldom	Unlikely	possible	No	Professional designed and proper for operation
8.8	Inadequate design or location of visual display units	Screen for display	N/A	Seldom	Unlikely	possible	Very low	Well designed for display and observation
9.0	Combination of hazards	None	N/A	Seldom	Unlikely	possible	Very low	
10.0	Unexpected start-up, unexpected overrun/ over speed (or any similar malfunction) from:							See below
10.1	Failure/disorder of the control system	Control system	Minor	Seldom	Unlikely	possible	Very low	
10.2	Restoration of energy supply after an interruption	None	N/A	Seldom	Unlikely	possible	Very low	
10.3	External influences on electrical equipment	None	N/A	Seldom	Unlikely	possible	No	
10.4	Other external influences (gravity, wind, etc.)	Stability	Unlikely	Seldom	Very low	possible	Minor	Safety requirement provided in the user manual for the wind influences
10.5	Errors in the software	None	N/A	Seldom	Unlikely	possible	No	

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	None	N/A	Seldom	Unlikely	possible	Very low	Professional required, no hazards.
11.0	Impossibility of stopping the machine in the best possible conditions	Whole machine	N/A	Seldom	Unlikely	possible	Very low	Energy supply switch provided
12.0	Variations in the rotational speed of tools	None	N/A	Seldom	Unlikely	possible	No	
13.0	Failure of the power supply	Engine	Moderate	Seldom	Unlikely	possible	Very low	The machine would stop working immediately once the failure presented, no hazard
14.0	Failure of the control circuit	The control circuit	N/A	Seldom	Unlikely	possible	No	No such hazard
15.0	Errors of fitting	None	N/A	Seldom	Unlikely	possible	No	Proper instructions in user manual
16.0	Break-up during operation	None	N/A	Seldom	Unlikely	possible	No	Reliable parts used
17.0	Falling or ejected objects or fluids	Obejects falling	Moderate	Seldom	Unlikely	possible	Very low	Overhead guard provided
18.0	Loss of stability / overturning of machinery	Whole machine	Moderate	Seldom	Unlikely	possible	Very low	The truck is enough stability and comply with stability requirement
19.0	Slip, trip and fall of persons (related to machinery)	Steps	N/A	Seldom	Unlikely	possible	Very low	Skid-proof design for steps and platform and guard rails provided
Additional hazards, hazardous situations and hazardous events due to mobility								
20.0	Relating to the travelling function							See below
20.1	Movement when starting the engine	Engine	Moderate	Seldom	Unlikely	possible	Very low	Key switch provided for starting the engine
20.2	Movement without a driver at the driving position	Movement for the truck	Moderate	Seldom	Unlikely	possible	Very low	Key switch and seat switch provided for starting the engine
20.3	Movement without all parts in a safe position	None	N/A	Seldom	Unlikely	possible	Very low	All parts fitted steadily
20.4	Excessive speed of pedestrian controlled machinery	N/A	N/A	Seldom	Unlikely	possible	No	
20.5	Excessive oscillations when	N/A	N/A	Seldom	Unlikely	possible	No	

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
	moving							
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilized	The truck	Moderate	Seldom	Unlikely	possible	Very low	Brakes provided for moving or parking
21.0	Linked to the work position (including driving station) on the machine							See below
21.1	Fall of persons during access to (or at/from) the work position	Driver in the seat	Moderate	Seldom	Unlikely	possible	Very low	Safety belt provided for the seat
21.2	Exhaust gases/lack of oxygen at the work position	N/A	N/A	Seldom	Unlikely	possible	No	
21.3	Fire (flammability of the cab, lack of extinguishing means)	None	N/A	Seldom	Unlikely	possible	No	
21.4	Mechanical hazards at the work position:							See below
	a. contact with the wheels;	Work position	Moderate	Seldom	Unlikely	possible	Very low	Comply with the safety distance
	b. rollover;	Stability	Moderate	Seldom	Unlikely	possible	Very low	The truck is enough stability and comply with stability requirement
	c. fall of objects, penetration by objects;	Objects falling	Moderate	Seldom	Unlikely	possible	Very low	Overhead guard provided
	d. break-up of parts rotating at high speed;	None	N/A	Seldom	Unlikely	possible	Very low	
	e. contact of persons with machine parts or tools (pedestrian controlled machines).	None	N/A	Seldom	Unlikely	possible	None	
21.5	Insufficient visibility from the work positions	Visibility	Minor	Seldom	Unlikely	possible	Very low	Sufficient visibility
21.6	Inadequate lighting	lighting	Minor	Seldom	Unlikely	possible	Very low	Adequate lighting
21.7	Inadequate seating	seating	Minor	Seldom	Unlikely	possible	Very low	Adequate seating
21.8	Noise at the work position	The whole machine	Minor	Seldom	Unlikely	possible	Very low	The noise level is provided in the user manual
21.9	Vibration at the work position	N/A	N/A	Seldom	Unlikely	possible	No	
21.10	Insufficient means for evacuation/emergenc	Emergency exit	Moderate	Seldom	Unlikely	possible	Very low	Sufficient means for emergency exit

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
	y exit							
22.0	Due to the control system							See below
22.1	Inadequate location of manual controls	Control system	Minor	Seldom	Unlikely	possible	Very low	Adequate location
22.2	Inadequate design of manual controls and their mode of operation	Control system	Minor	Seldom	Unlikely	possible	Very low	Professionally design
23.0	From handling the machine (lack of stability)	N/A	N/A	Seldom				
24.0	Due to the power source and to the transmission of power							See below
24.1	Hazards from the engine and the batteries	Engine and Battery	Minor	Seldom	Unlikely	possible	Very low	Comply with safety requirement
24.2	Hazards from transmission of power between machines	None	N/A	Seldom	Unlikely	possible	None	
24.3	Hazards from coupling and towing	N/A	N/A					
25.0	From/to third persons	N/A	N/A					
25.1	Unauthorized start-up/use	Start-up/use	Minor	Seldom	Unlikely	possible	Very low	Key switch and seat switch provided
25.2	Drift of a part away from its stopping position	Parking	Moderate	Seldom	Unlikely	possible	Very low	Brakes provided for parking
25.3	Lack or inadequacy of visual or acoustic warning means	Warning means	Minor	Seldom	Unlikely	possible	Very low	Warning notice and symbols provided
26.0	Insufficient instructions for the driver/operator	None	N/A	Seldom	Unlikely	possible	Very low	User manual provided
Additional hazards, hazardous situations and hazardous events due to lifting								
27.0	Mechanical hazards and hazardous events							See below
27.1	from load falls, collisions, machine tipping caused by:							See below
27.1.1	lack of stability	Stability	Moderate	Seldom	Unlikely	possible	Very low	The truck is enough stability and comply with stability requirement
27.1.2	uncontrolled loading - overloading -	Loading/overload	Moderate	Seldom	Unlikely	possible	Very low	Comply relevant safety requirement

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
	overturning moments exceeded	ding						
27.1.3	uncontrolled amplitude of movements	Amplitude of movements	Moderate	Seldom	Unlikely	possible	Very low	Limit device provided for lifting movements
27.1.4	unexpected/unintended movement of loads	Movement of loads	Moderate	Seldom	Unlikely	possible	Very low	Safety requirement for load expected movement in user manual
27.1.5	inadequate holding devices/accessories	None	N/A	Seldom	Unlikely	possible	Very low	
27.1.6	collision of more than one machine	None	N/A	Seldom	Unlikely	possible	Very low	
27.2	from access of persons to load support	None	N/A	Seldom	Unlikely	possible	Very low	
27.3	from derailment	N/A	N/A	Seldom	Unlikely	possible	N/A	
27.4	from insufficient mechanical strength of parts	Mechanical strength	Moderate	Seldom	Unlikely	possible	Very low	Relevant strength calculation provided
27.5	from inadequate design of pulleys, drums	None	N/A	Seldom	Unlikely	possible	Very low	
27.6	from inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine	Chains	Moderate	Seldom	Unlikely	possible	Very low	Certificated chains used
27.7	from lowering of the load under the control of friction brake	Lowering load	Moderate	Seldom	Unlikely	possible	Very low	No such hazards
27.8	from abnormal conditions of assembly/testing/use/maintenance	Assembly /testing/use/ maintenance	Moderate	Seldom	Unlikely	possible	Very low	Safety requirement provided in user manual
27.9	from the effect of load on persons (impact by load or counterweight)	Load	Moderate	Seldom	Unlikely	possible	Very low	Safety requirement provided in user manual
28.0	Electrical hazards							See below
28.1	from lightning	Lighting	Minor	Seldom	Unlikely	possible	Very low	
29.0	Hazards generated by neglecting ergonomic principles	None	N/A	Seldom	Unlikely	possible	Very low	
29.1	insufficient visibility from the driving position	Driving position	Minor	Seldom	Unlikely	possible	Very low	Sufficient visibility
Additional hazards, hazardous situations and hazardous events due to underground work								

EN ISO 12100:2010								
No.	Hazard	Place of hazard	Severity	Exposure	Probability of occurrence	Possibility of avoidance	Risk	Methods adopted to eliminate hazards
30.0	Mechanical hazards and hazardous events due to:	N/A						Not for underground work
30.1	Lack of stability of powered roof supports	N/A						
30.2	Failing accelerator or break control of machinery running on rails	N/A						
31.0	Restricted movement of persons	N/A						Not applicable
32.0	Fire and explosion	N/A						
33.0	Emission of dust, gases etc.	N/A						
Additional hazards, hazardous situations and hazardous events due to the lifting or moving of persons								
34.0	Mechanical hazards and hazardous events due to:	N/A						Not for lifting or moving of persons
34.1	Inadequate mechanical strength - inadequate working coefficients	N/A						
34.2	Failing of loading control	N/A						
34.3	Failing of controls in person carrier (function, priority)	N/A						
34.4	Overspeed of person carrier	N/A						
35.0	Falling of person from person carrier	N/A						Not applicable
36.0	Falling or overturning of person carrier	N/A						Not applicable
37.0	Human error, human behaviour	N/A						Not applicable

*****The End*****