SAFETY BULLETIN

Ref Document No.	SB24001	Issue No.	2
Subject	CT10LP Lift Rating Information Document		
Release Date	26th September 2024		

Purpose – To advise COALTRAM® owners and operators that an updated CT10LP Lift Rating Information document has been published and is available on the PPKME website.

Applicability – PPKME CT10LP

Background

Two incidents in early 2024 involved a CT10LP lifting a bolting rig basket attachment; these incidents are described in NSW Resources Regulator safety bulletin SB24-02.

Investigation into the incidents determined that the combination of the attachment mass and Centre of Gravity from the QDS master hitch were outside the capability of the CT10LP. Subsequently, a WHSA improvement notice was issued, according to which PPKME must provide any conditions that are necessary to ensure CT10LP loader is without risks to health and safety when using attachments.

Though the nominal 10 tonne lift capacity of CT10LP covers a large range of the loader's working conditions, there are circumstances under which this capacity is reduced. This could be unclear and may pose risks to the health and safety of the users if not fully understood. Hence, PPKME provided the users with guidelines in this regard through the DW-084 CT10LP Lift Rating Information document.

Following feedback from key stakeholders, the information document has been updated. DW-084 version 3 supersedes previous versions and is intended to provide information which is easier to interpret. The document also provides standard lift capacity ratings as per AS ISO 14397.1-2021.

Investigations/Findings

Engineering computation was executed to specify the minimum requirements that CT10LP users should comply with so that they could ensure the loader is without risks to health and safety when using attachments.

Investigation has been launched for all PPKME loaders. Relevant Lift Rating Information documents will be released in due course.

Recommendations

PPKME recommend reviewing the CT10LP Lift Rating Information document.

PPKME welcomes working with customers on detailed assessments of miscellaneous implements and/or scenarios outside the scope of this document.

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MINING EQUIPMENT

COALTRAM® CT10LP

LIFT RATING INFORMATION

Introduction

The COALTRAM CT10LP LHD has a nominal 10 tonne lift rating, as per existing PPKME operator and service manuals.

Capacity	kg
CT10LP Lift Capacity – QDS Forkset P/N 5520001117 CoG 600mm out from tyne vertical face, 500mm up from tyne horizontal face	10,000

The lift rating of the COALTRAM® CT10LP is based on the load capacity of tyres, the integrity of mechanical/structural components, the pressure capacity of hydraulic cylinders and the stability of the machine. Engineering calculations for the CT10LP under static conditions suggest:

1. in terms of cylinder capacity, the crowd cylinder is the limiting factor, and
2. in terms of machine stability, forward tipping is the most restrictive destabilising condition.

As the minimum requirement, users should make sure that their desired operating condition agrees with the presented data in the next two sections.

The simplified stationary lift capacity of CT10LP is summarized in Figure 1 and Figure 2. These figures take into account the hydraulic cylinder capacity and machine stability, as stated. Figure 3 illustrates the zero-tilt configuration on which the results are calculated.

The CT10LP QDS master hitch has a 5-degree backward inclination angle with respect to the vertical line when the base of the PPKME QDS Forkset is parallel to the ground. Deviation from this inclination angle could reduce the lift capacity of the vehicle, particularly when the hitch is tilted forward. The relative orientation of the master hitch should be checked, especially for miscellaneous attachments.

The reader is encouraged to refer to the last section of this document for guidance on the usage of the presented graphs.

The rated operating capacity of CT10LP, as per AS ISO 14397.1, under typical operating conditions is also calculated for different PPKME attachments (Table 2).

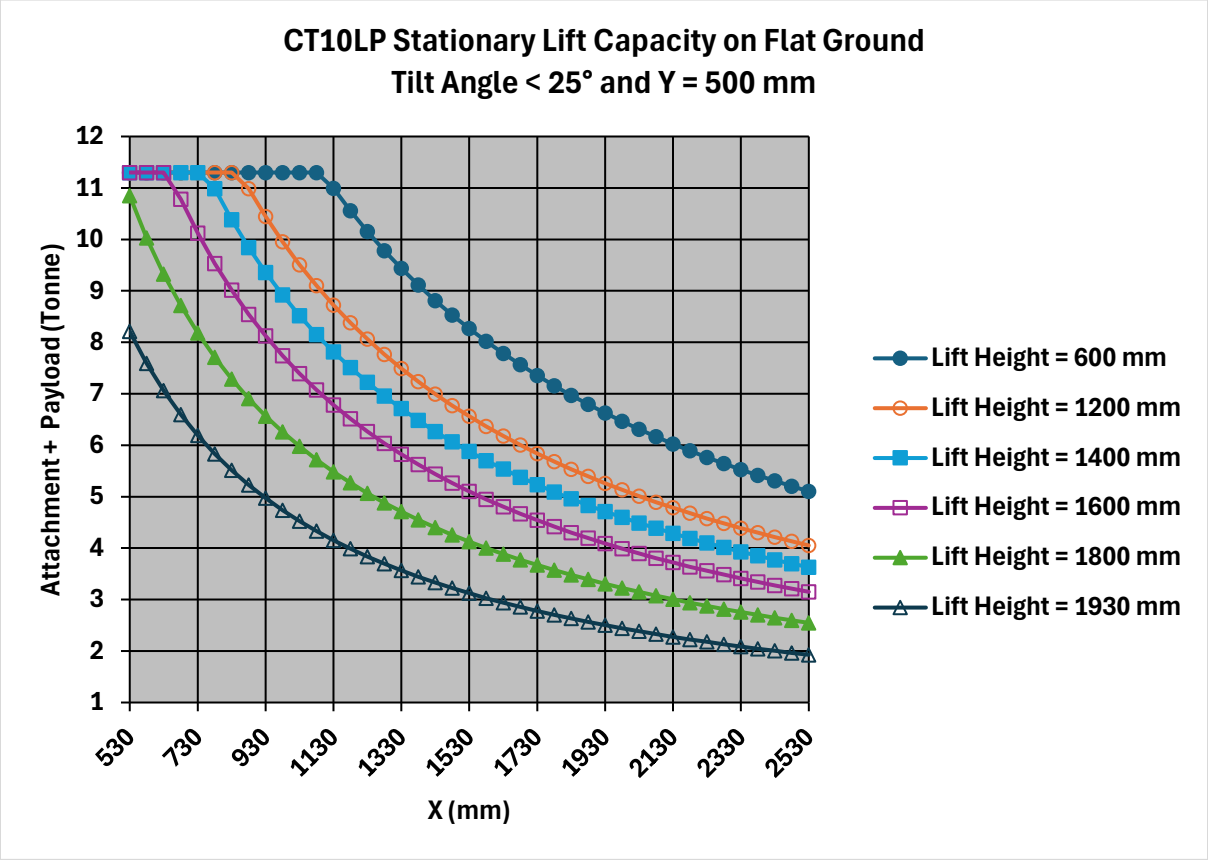


Figure 1 CT10LP stationary lift capacity on flat ground

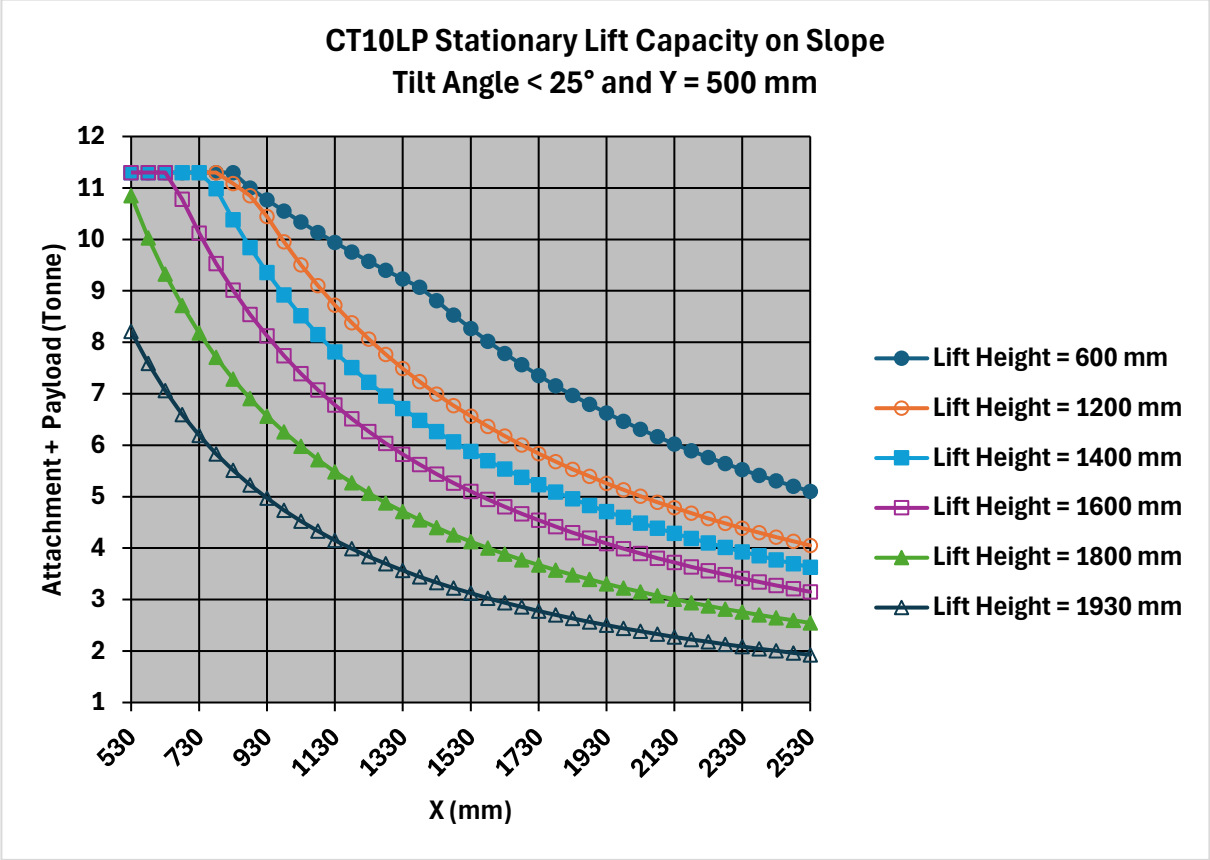


Figure 2 CT10LP stationary lift capacity on slope (longitudinal grade = 1:4 & lateral grade = 1:8)

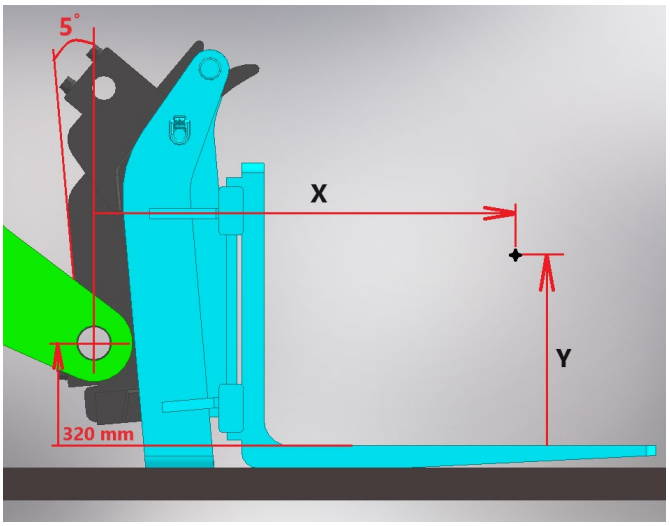


Figure 3 QDS zero-tilt configuration

Recommendations

Results are approximate and may vary considerably due to road conditions, tyre diameters, tyre fill methods and vehicle configuration. Further safety factors are recommended for dynamic conditions.

The following recommendations are made:

1. Load should be carried as low to the floor as practicable during transport. First gear to be used when carrying heavy loads or when the bottom of the attachment is higher than 1 metre above floor level.
2. Roadway should be kept clean of loose coal or other debris as much as practicable. The effect of uneven ground on stability must be considered.
3. The vehicles accessible critical stress points should be inspected for cracks and confirmed via NDT / crack testing if required. Refer OEM service sheets.
4. Note that Figure 1 and Figure 2 are based on an assumed load which is laterally centred on the attachment. The effect of off-centre loads should be controlled by addition of a safety factor.
5. Operators should be suitably trained and competent with loader operation, including but not limited to completing COALTRAM® operator training.
6. Extensions/attachments fitted by users must be suitably rated, certified and specifically risk assessed.
7. Note that Figure 1 and Figure 2 assume forward tilt angles up to 25 degrees and a vertical centre of gravity up to 500mm. Lift capacity outside these parameters must be assessed separately. The crowd cylinder has reduced mechanical advantage in high lift scenarios, leading to a reduced lift capacity of the machine.
8. Lifting of personnel must be specifically risk-assessed.

Use of miscellaneous implements and/or scenarios outside the scope of this document must be separately assessed.

Recommended Tyres

Tyre Brand	Tyre Type	Fill Type
Michelin	XMINED2 17.5x25	P/PW/F/I
	XKA 17.5x25	P/PW/F/I
Ty Cushion	49/20.5x25U	S
	52/20.5X25D	S
	17.5x25D	S
	45/20.5x25U	S
Infinity	1425x450	P/PW/F/I
Pirelli	CE11 17.5x25	P/PW/F/I

Tyre Fill Type	Abbreviation
Pneumatic	P
Pneumatic/Water	PW
Replaceable Inserts	I
Foam Fill	F
Solid rubber	S

Rated Operating Capacity as per AS ISO 14397.1:2021

To provide a consistent means of comparing loader capacities, the rated operating capacity of CT10LP is determined as per AS ISO 14397.1:2021, when used with different buckets and forks. It is not intended to define actual capacities that might be observed in any specific conditions. Certain attachments can exceed the normal operating capacity and will require restricted machine operating conditions. For the intended use of the attachment, refer to its manufacturer's instructions.

According to AS ISO 14397.1:2021, the rated operating capacity (N) is assessed based on tipping load at maximum reach (m_{tip}) multiplied by a stability factor (k) and lift capacity to maximum height (m_{lift}), whichever is smaller.

m_{tip} is defined as "minimum mass, in kilograms, that, when placed in the loader bucket or on forks at maximum moment arm position, will cause the loader to achieve the tipping limit condition in its least stable configuration, with the loader placed on a hard, level surface and the resultant force acting vertically through the centroid of the rated bucket volume as specified in ISO 7546 or the fork load centre."

The fork load centre distance (D) is determined as a point on the longitudinal centreline of the machine at half the distance from the most rearward point of the load opening to the tip of the fork as shown in Figure 4.

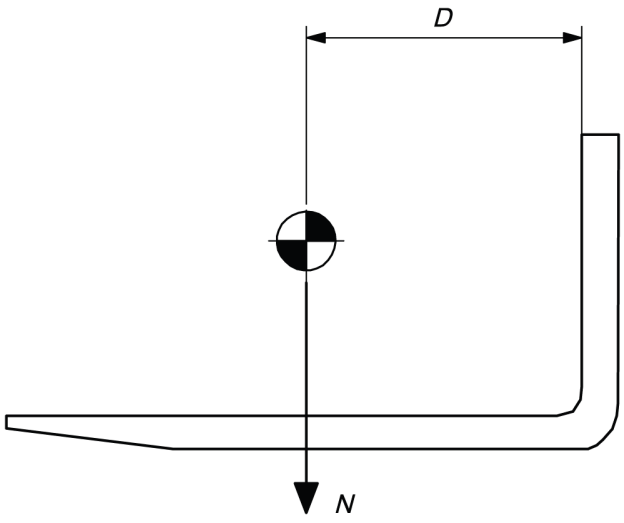


Figure 4 Fork load centre distance (D) as per AS ISO 14397.1:2021

m_{lift} is defined as "mass, in kilograms, which can be lifted from the ground to the maximum height using the lift cylinder(s) at hydraulic circuit pressure, with the bucket positioned to hold the maximum load, or the forks positioned horizontally, and with the resultant force acting vertically through the centroid of the rated bucket volume as specified in ISO 7546 or the fork load centre."

Depending on the type of attachment and the condition of terrain, different stability factors are recommended, as listed in Table 1.

Table 1 Stability factor as per AS ISO 14397.1:2021

Attachment type	***Ground condition***	***k***
Bucket	*All*	*0.5*
Fork	*Rough terrain*	*0.6*
	Firm and level ground	*0.8*

The rated operating capacity values for different attachments of CT10LP are listed in Table 2.

Table 2 CT10LP Rated Operating Capacity determined following AS ISO 14397.1:2021

Attachment Type	**Ground condition**	***N* (kg)**
Bucket (volumetric capacity = 3.4 m^3) P/N 5520006011	All	4800
Bucket (volumetric capacity = 3.0 m^3) P/N 5520001243		4900
Bucket (volumetric capacity = 2.6m^3) P/N 5520005750		5400
Fork (hydraulic) P/N 5520002879	Rough terrain	6600
	Firm and level ground	7000
Fork (manual) P/N 5520001117	Rough terrain	6800
	Firm and level ground	7200

The data presented in this section makes assumptions as per AS ISO 14397.1:2021

1. In general:
    - unless mentioned otherwise, the data are relevant to normal operation which refers to operating on hard, substantially smooth and level surface with a maximum travel speed of 15 km/h.
2. While handling a heavy single object (HSO) using forks:
    - the machine must be in a straight-ahead position when loading the transport carrier.
    - the load should be in a fully rolled back position.
    - the maximum travel/transport speed should be less than 2 km/h.

Lift Capacity Evaluation Procedure

Users can estimate the stationary lift capacity of CT10LP with any attachments for specific working conditions by using the following procedure.

1. Determine the maximum tilt angle of the operating conditions based on the reference zero-tilt configuration shown in Figure 5 (e.g. tilt angle is +5 degrees when the master hitch has a 0-degree backward inclination angle with respect to the vertical line).

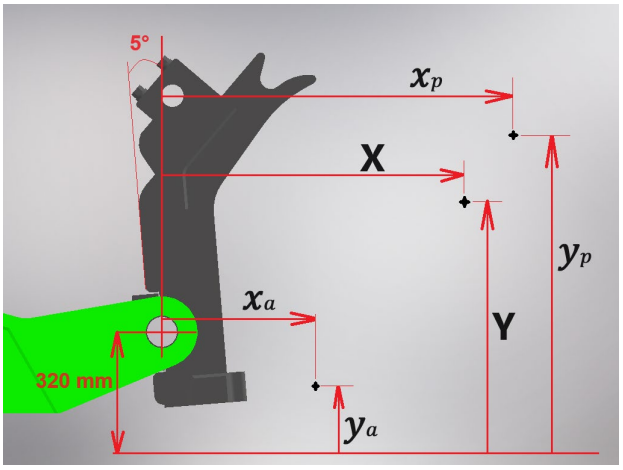


Figure 5 QDS zero-tilt configuration based on which vertical and horizontal positions should be measured

2. Determine the maximum longitudinal and lateral gradient of the operating conditions of machine if the maximum tilt angle of the operating conditions is less than 25 degrees. If not, do not continue because individual investigation should be done.
3. Proceed to next steps if the maximum longitudinal and lateral gradients of the operating conditions do not exceed 1:4 and 1:8, respectively. If not, do not continue because individual investigation should be done.
4. Specify the weight of the attachment (w_a) as well as the horizontal (x_a) and vertical (y_a) positions of the attachment's Centre of Gravity.

5. Specify the payload (w_p) as well as the horizontal (x_p) and vertical (y_p) positions of its Centre of Gravity.
6. Work out the horizontal (X) and vertical (Y) positions of the total ($w_a + w_p$) load's Centre of Gravity as below.

$$X = \frac{w_a \times x_a + w_p \times x_p}{w_a + w_p}$$

$$Y = \frac{w_a \times y_a + w_p \times y_p}{w_a + w_p}$$

Note: all the measurements should be based on the reference lines as shown in Figure 5, where the master hitch has a 5-degree backward inclination angle with respect to the vertical line (the so-called zero-tilt configuration).

7. Proceed to next steps if Y is less than 500 mm. If not, do not continue because individual investigation should be done.
8. Refer to **Figure 1** if operating on flat level ground. If not, select **Figure 2**.
9. Determine the maximum lift height of the operating conditions.
10. Select a curve with the nearest value (smaller than or equal to) to the maximum lift height of the operating conditions.
11. At the X value calculated in step 6, draw a vertical line perpendicular to the horizontal axis of the graph selected in step 8.
12. Draw a horizontal line to the drawn vertical line where it crosses the selected curve of the graph.
13. Read the value of total weight where the horizontal line crosses the vertical axis.
14. The lift scenario is acceptable if the read value is larger than the actual total weight ($w_a + w_p$). If not, compromise on the maximum lift height of the operating conditions when possible.
15. Repeat step 10 through 14 unless no compromise is applicable.

Worked examples

Example #1

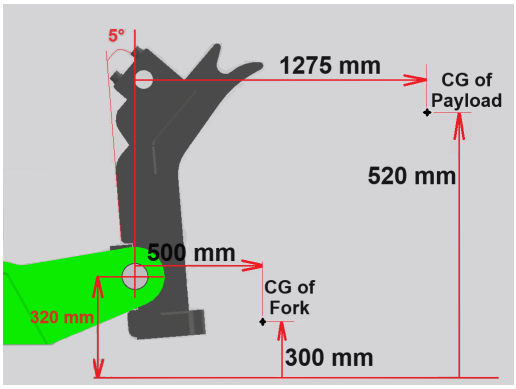
Is CT10LP capable of lifting a 5.7-tonne object up to 1000 mm using a 1.3-tonne attachment when the master hitch experiences a 25-degree forward inclination angle with respect to the vertical line?

Solution:

A 25-degree forward inclination angle of the master hitch corresponds to a 30-degree tilt angle. Therefore, the operating condition does not match the graphs presented in this report and an individual investigation should be carried out.

Example #2

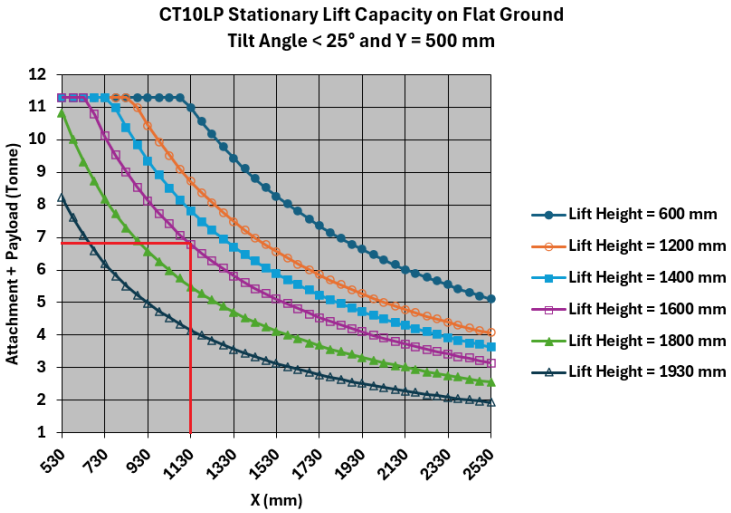
Is CT10LP, on flat ground, capable of lifting a 5.7-tonne object up to 1600 mm using a 1.3-tonne attachment with zero tilt angle? The horizontal and vertical position of the object and attachment's Centre of Gravity are shown below.



Solution:

$$X = \frac{1.3 \times 500 + 5.7 \times 1275}{1.3 + 5.7} \approx 1130\ mm$$

$$Y = \frac{1.3 \times 300 + 5.7 \times 520}{1.3 + 5.7} \approx 480\ mm$$



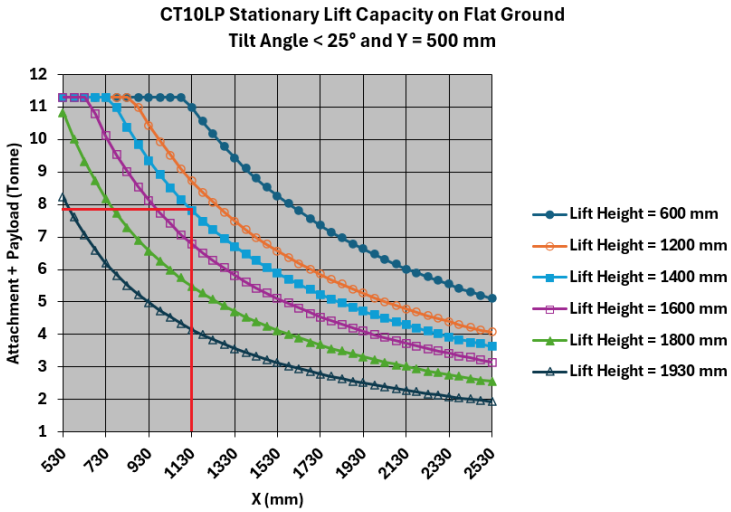
The read value is 6.8 tonnes which is less than the total 7 tonnes. So, the lift scenario is not acceptable.

Example #3

In Example #2, what is the maximum acceptable lift height?

Solution:

$$7.8 > 7.0$$



The maximum acceptable lift height is 1400 mm.

Example #4

In Example #2, calculate the safety factor if the maximum lift height was 600 mm.

Solution:

$$S.F. = \frac{11}{1.3 + 5.7} \approx 1.57$$