Electrification

Road-rail trolley with lifting platform

UNAC
HYDROSTATIC VEHICLE CREATOR

Description of the X3

UNAC-X3-ST-06-EN


Powered by CAT

TECHNICAL SPECIFICATIONS

SUMMARY

1. INTRODUCTION

The self-propelled trolley X3 has been designed thanks to great experience of our customers, electrification contractors. Its characteristics and its performances have been elaborated in order to make possible to reach in a secure, ergonomic and fast way a maximum of adjusting points corresponding to central supports and cantilevers which constitute the electrification network. In addition, the X3 is supplied with an equipotential contact mast for allowing residual energy to go down to hearth and by the way to achieve a reading of the contact line position (stagger).

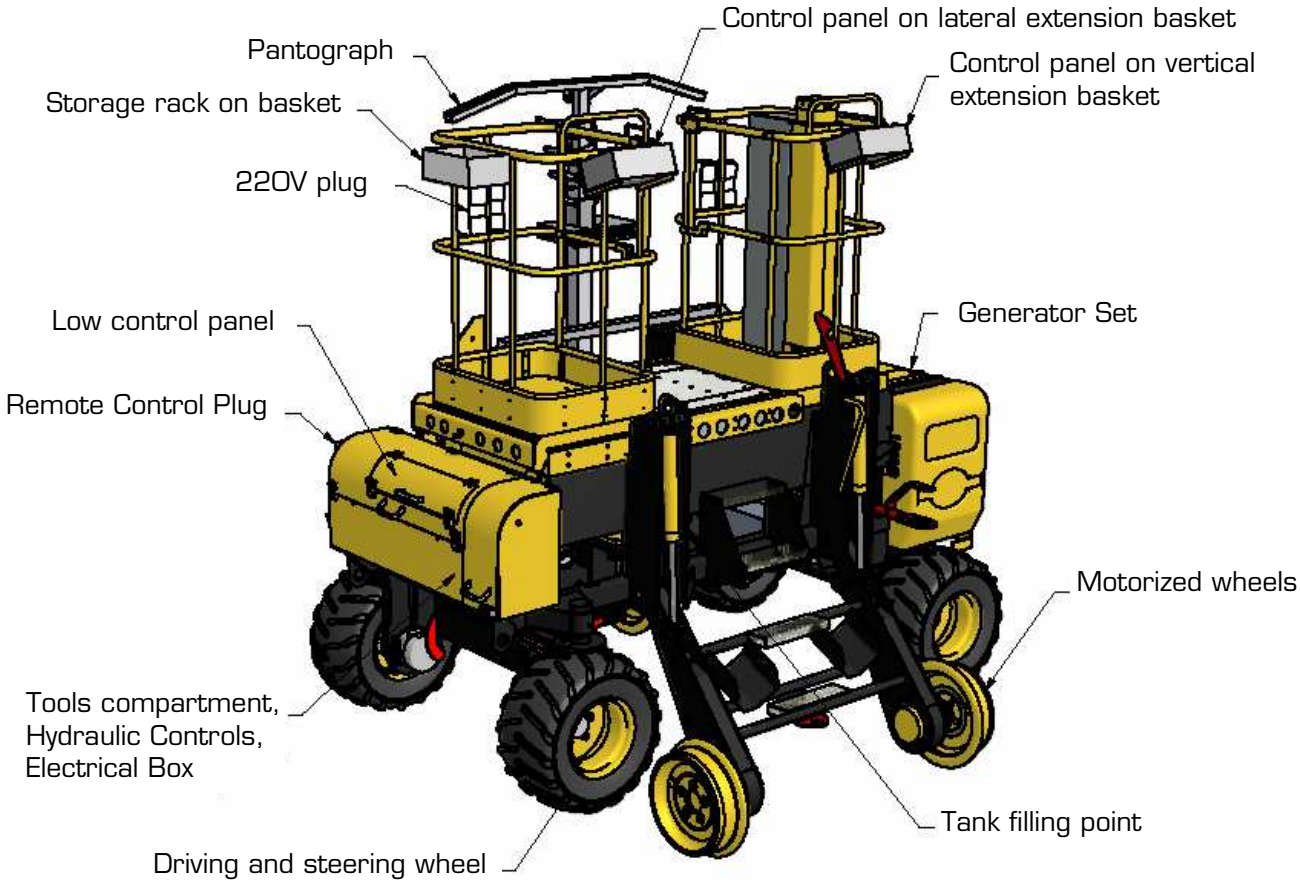
The study of this product has been directed with the greatest care, integrating the maximum of industrial manufacture notions and maintenance ease. All the design has been achieved thanks to integral 3D modelling made on last generation software, which has permitted to optimise each of the mechanical part for a strong and reliable design.

Designed to comply with the most demanding railway standards for safety, the system has also been defined in dialogue with CRAMIF, a state body specialized in working risk management contributing to the health state policy. The system notably complies with the following national and European standards for health and safety:

- Machine Directive 2006/42/CE
- NF EN 280 - Provisions for persons and good safety during use of mobile elevating platform for personnel, all types and all capacities
- NF F 58-051 - Personnel elevator on railway vehicles
- NF F 58-002 - Working accreditation for railway equipments
- NF F 60-100 - Railway rolling stock – Protection against electrical shocks – principles

Main components, such as the fuel engine or the scissor platform, have been selected from the range of well-known manufacturer.

Such approach gives the maximum of guaranties for heavy-duty equipment with high reliability and low maintenance.



3D view of the machine, all baskets in transport position, travelling on railway track

2. GENERAL DESCRIPTION OF THE SELF-PROPELLED TROLLEY X3

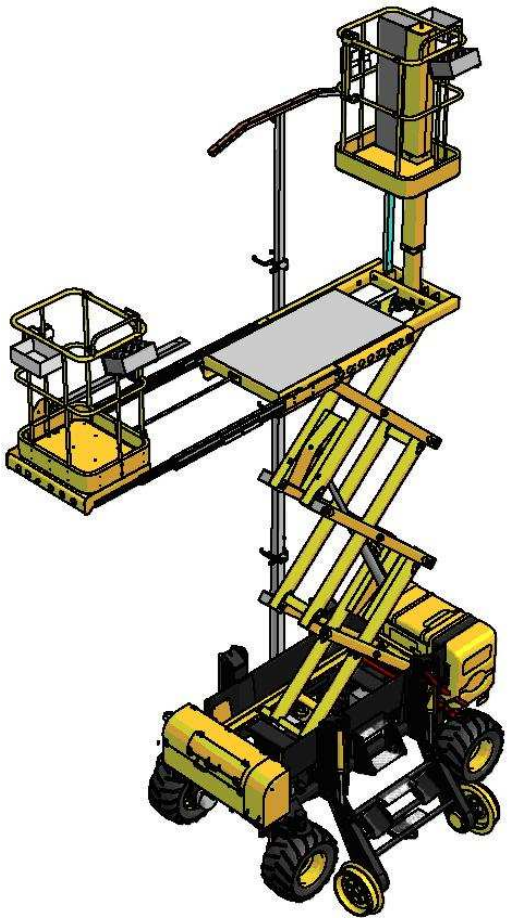
The self-propelled trolley X3 is made of an **all terrain** chassis with 4 drive wheels which bears the motorization and the lifting platform and on which is mounted the articulated railway set. The supporting structure is achieved with high-strength and high-elastic limit steel stringers.

A telescopic pantograph is assembled to the chassis in order to come into sensitive contact with the contact wire for enabling the escape of residual currents to the hearth before working on the catenary.

An articulated mechanical stop is mounted between wheels, under the chassis, to prevent the system to cross the railway vehicle gauge of the opposite track during setting on track.

The scissor type lifting platform receives two independent working baskets.

On track with TSO Caténaire in France



3D View of the equipment, all baskets in working position

2.1. Purpose of use of the vehicle

The X3 has been designed with the main aim to make possible a very quick and secure intervention in all railway track points, in order to achieve the necessary works on catenary line.

Easy to transport on road thanks to its adapted trailer, proposed as an option, the system is then self-propelled with hydrostatical motion, on ground as well as on rail tracks.

Very equilibrated, the system shows a very good attack angle and easily overcomes the obstacles surrounding the railway tracks like the trenches, the embankments or the ballast. It thus accesses to the track by coming the closest as possible of the whished working point, which represents an actual optimized intervention in the time as there is no need to organize specific access or to waste time due to heavy logistic arrangements.

In the case of night works for instance, operators can start the works within the best time-limit, just 5 minutes after getting the green light from railway administration, and continue to work up the last possible minute since the system can be removed and set free the track very quickly (few minutes).

Likewise, if the electrification works need to pass from one track to the opposite one, just few minutes are requested to continue working on the other track, when other systems like track cars or heavy railway vehicles often need more than half-hour.

During the construction works of new lines or during maintenance of old lines, the trolley can be stored close to the tracks at the end of the day or the night and therefore make possible immediate work resumption the day or night after. Besides, it is also possible to other railway working units to pass on the track, the system having the capability to go out and on the track very quickly.

Moreover, it is not requested to have dedicated driver. Each operator can on board take the control of the system and manage the on track travelling, at 5km/h maximum

speed with working platform lifted, and up to 18km/h with platform in non-working position.

The X3 trolley is therefore a very ergonomic tool as regards to the yard logistic. It is also for the achievement of the electrification works themselves. Indeed, its lifting platform permits to operator to work in a synchronized or in an independent way thanks to the exclusive design with two sliding baskets. One basket can slide horizontally in the direction of the post when the second one can move up to access and work on the catenary support cable.

The characteristics of the self-propelled trolley are the followings:

2.2. Main data of the vehicle

- Dimensions, on road, all equipments set off (Lxlxh): 2 935 x 2 425 x 2 620 mm
- Weight: 2 800 kg
- Maximum railway speed (working / travelling): 5 / 18 km/h
- Maximum road speed: 5,8 km/h
- Maximum passable slope in all-terrain mode: 100 %
- Maximum railway slope: 3,5 %
- Maximum railway cant: 180 mm
- Rail gauge: 1 435 mm

3. TECHNICAL CHARACTERISTICS

3.1. All-terrain mode

The vehicle is set with low pressure tires. The technical characteristics of the all-terrain motorization are the followings:

- Number of wheels (drive / steering): 4 / 2
- **Hydrostatic** type transmission: 2 speeds, with one gear motor by wheel
- Hydraulic motors: Poclain, for the steering wheels
- Speed, slow mode: de 0 à 2,2 km/h
- Speed, fast mode: de 0 à 5,8 km/h
- Brakes: hydrostatic
- Tires: 12" stud tires

Nota: The platform shall not be used with the road wheels.

During all-terrain motions, the system is controlled by the operator thanks to the cabled remote control.

A control board is accessible on the vehicle for authorizations management.

3.2. Railway mode

The motions on the rail tracks are achieved by 4 hardened steel wheels driven by hydraulic motor.

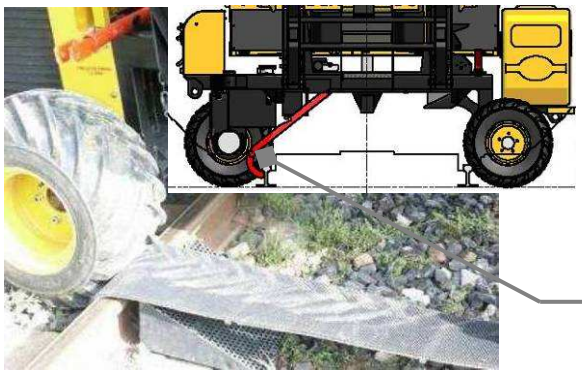
The setting and the lifting of the wheels are ensured by an articulated mechanical unit, moved and operated by 4 synchronized hydraulic cylinders. When the railway system is in turned down onto the track, it presents in its structure a step for an easier access to the platform.

The hydraulic motors of the railway wheels are equipped with positive action braking discs. Brakes are activated as soon as the motor is switched off or when emergency stop is engaged. During railway travels, the braking system is designed to stop the vehicle within required distances as mentioned in the NF F 58-002 standard. Besides, an accelerating and a decelerating ramp are preset into a PLC in order to manage the braking operation and thus, avoid any slipping between wheels and rails and maintain the system in the perfect balance. If necessary, those PLC parameters can be adjusted during the commissioning of the machine according to particular local requirements.

The railway system has the following characteristics:

- Wheels diameter: 420 mm
- Transmission: hydrostatic type, one motor by wheel
- Hydrostatic braking: by absence of pressure
- Railway speed (working / travelling): from 0 to 5,0 km/h / 18,0 km/h
- Turning up of front and rear wheel sets: by cylinders and check valves
- System against encroachment of neighbouring vehicle gauge: with mechanical stop
- Maximum working and travelling cant: 180 mm
- Track gauge: 1 435 mm
- Maximum track gradient: 3,5 %

The machine is also equipped with a parking brake directly controllable by the operator in its basket. This additional braking system prevents any motion of the stopped vehicle even in a 40 ‰ gradient track.



Mechanical stop preventing any encroachment by the system of the opposite railway vehicle gauge during the setting on track of the trolley

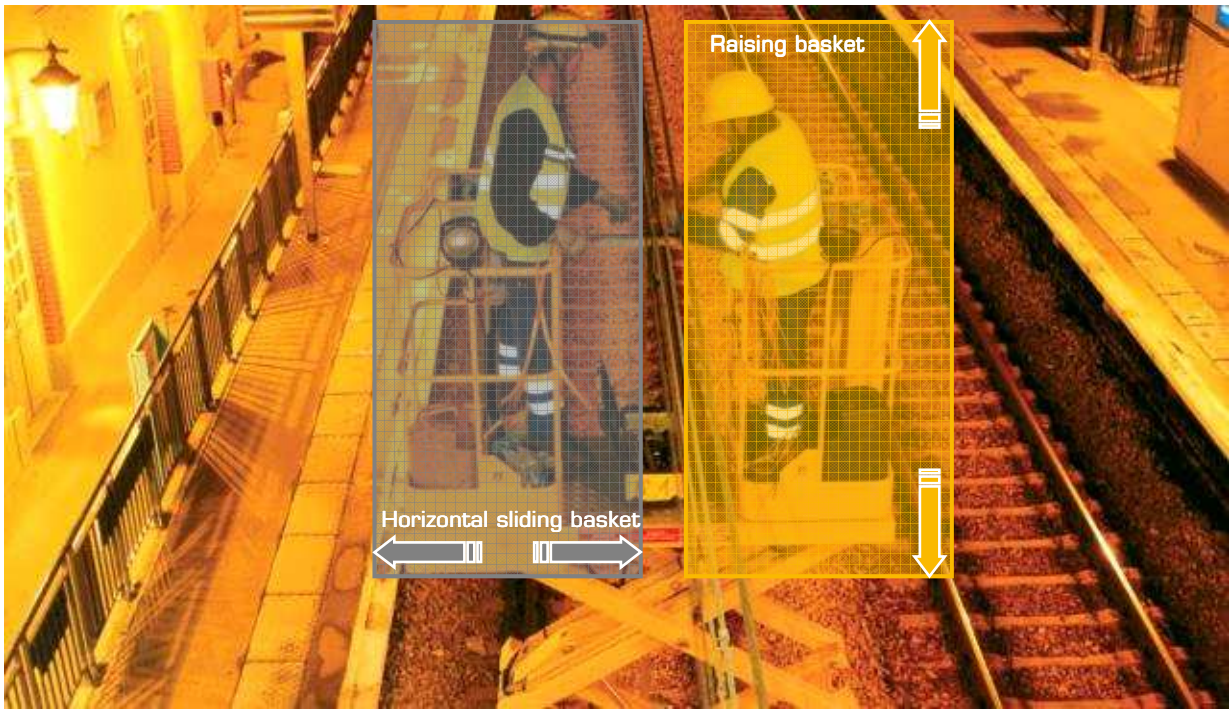
Nota: The self-propelled trolley is delivered with a set of 2 light triangular pads for making easier the rails crossing by the tires. Also 2 semi-flexible rubber bands will conserve the ballast distribution. Those elements can be stored on board.

3.3. The lifting platform

The X3 chassis supports the lifting platform designed to receive 2 persons.

During the platform design, a particular attention has been put on **safety** and on the working **ergonomics**.

Thus, the scissor type lifting motion is achieved by a hydraulic cylinder equipped with safety check valve. The platform is composed with 2 independent baskets each one designed to receive one operator. The lifting platform with exclusive design is totally dedicated to catenary works. Each basket has indeed the capability to slide on the platform chassis by motorized motion. One basket moves horizontally towards the lateral post, when the other basket moves vertically toward the catenary support cables and the cantilever extremity.



Thus, each operator works at the required height for the working point, the most often at the bust height which generally is the most comfortable position for more working efficiency.

The raising basket makes possible to work alternatively on the fastening elements at the catenary support cable level or at the contact wire level. The horizontal sliding basket permits to securely access to the fastening points along the cantilevers.

On the same platform, employees can work either face to face with contact wire between themselves in the middle, which avoids to operators to stoop under the catenary to pass from one side to the other or either simultaneously and freely on their basket for other surrounding tasks.

Works are therefore actually optimized and a **high working efficiency and ergonomics** is resulting from, each operator being at an ideal and comfortable position, always in activity, thus reducing to the maximum the idle times.

Each basket has a mechanical locking system which gives total security to the operator.

Individually accessible from each basket, a control desk permits to the operator to manage the basket position, the platform lifting and the travelling of the self-propelled trolley.

The main characteristics of the lifting platform are the followings:

- Number of baskets 2
- Maximum permitted load by basket: 1 person or 120 daN
- Maximum platform height, floor / rail: **4,90 m**
- Platform height in low position , floor / rail: 1,60 m
- **Additional elevation of the raising basket**: 1,10 m (total height of **6,00 m**)
- **Maximum lateral extension of the basket**: **1,90 m** (total maximal offset of **2,90 m**)
- Standard accessories: lighting, 4 adjustable 70 W lights
- Available electrical plug by basket 12V and 230V *
- Available controls for travelling speed, working mode: from 0 to 5,0 km/h **
- Basket dimensions: 800 x 650 x 1100 mm

* 230V plugs are assembled on the basket and shall be power supplied by an external GenSet to be connected on the chassis at the bottom of the platform (can be proposed as an option).

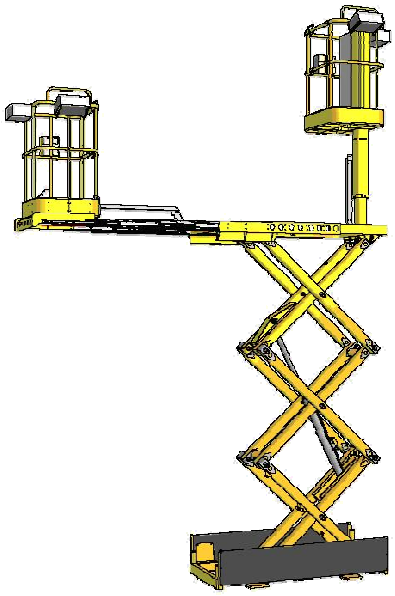
** From each basket.

With 120 daN of permitted load by basket, the lifting platform will also allow to load usual operator tools for catenary works.

Important:

To the maximum lateral distance and to the maximum height of each basket, it is necessary to add respectively 1m and 2m for knowing the maximum possible reaching distance by the operators. The above heights are indeed given from the rail to the basket floor.

Thus for example, from the raising basket, an operator will be able to achieve maintenance and mounting of the cantilever fastening system at **an actual maximum height of 8 m.**



3.4. The generator set

An energy group is provided with the system to ensure the hydraulic and electric power supply of all equipments.

In order to simplify the maintenance operation, the whole generator set - including diesel engine, control cabinet and control desk - has been installed together on a side of the machine. Elements which constitute the generator set are the followings:

- Engine: Diesel, 4 cylinders
- Engine manufacturer Caterpillar, C1 type
- Power: 19,7 KW at 2 800 rev/min
- Fuel tank: 30 litres
- Oil tank: 65 litres
- Hydraulic pumps: 2 pumps, 1 for transmission and 1 pour cylinders
- Control of platform and basket motions: electro-hydraulic distributors
- Control of the all-terrain drive: remote control with HARTING plug
- Hydraulic circuit: 190 litres
- Electrical cabinet: with integrated control buttons
- Control and safety management: by PLC and relays
- Battery 1x12V
- Emergency stops: 1 on control desk on low position, 1 by basket

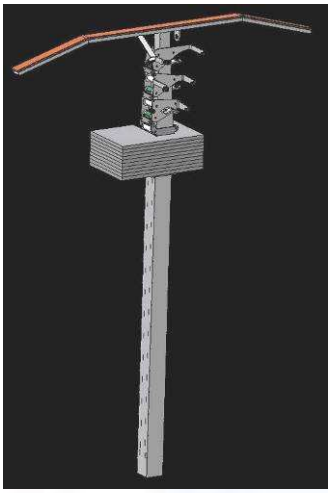
In addition to the usual robustness inherent in Caterpillars engines, the X3 engine has been chosen in order to give a high effective power while maintaining reasonable noise level emissions and satisfying to the level II of antipollution EU standards.

3.5. Emergency

Access to all mechanical, hydraulic or electrical parts can be made by simple opening of doors or panels. In case of hydraulic unit failure, a manual pump permits to lower the scissor platform and to set the machine out of the tracks. One emergency stop is available on each basket and one on the control desk at the bottom of the machine.

3.6. Equipotential mast

The trolley is equipped with an equipotential linking pantograph which is set at the beginning of the works in order to eliminate any residual energy from the catenary.



The pantograph is made of 4 telescopes with squared aluminium section, linked together by 35 mm wide belts. The 7kg pressure applied on the contact wire is obtained thanks to a counterweight made of metal plate for possible adjustments. The mast with telescopic deployment come thus into sensitive contact with the contact line and the applied force is constant.

The lifting of the bow is guided by rollers mounted on bearings, in order to limit the play of the telescope and guaranty robustness of the telescope for long life time.

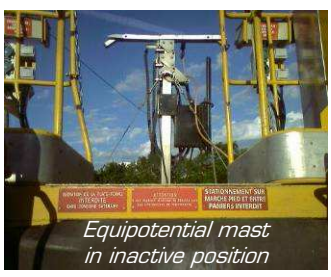
The lowering of the bow is simply made manually thank to a rope.

Once on low position, the pantograph is very low with only 3'010mm height from the road when put on its trailer.

A 95 mm^2 equipotential cable is conveyed for the correct earthing.

Equipotential mast in up position (working)

The mast can also be used to control the catenary position. Indeed, a measuring rule is integrated into the pantograph and permits to read the **catenary stagger** thanks to the position graduated indication going from -400mm to +400mm. The stagger reading is therefore visually made, directly on the rule.

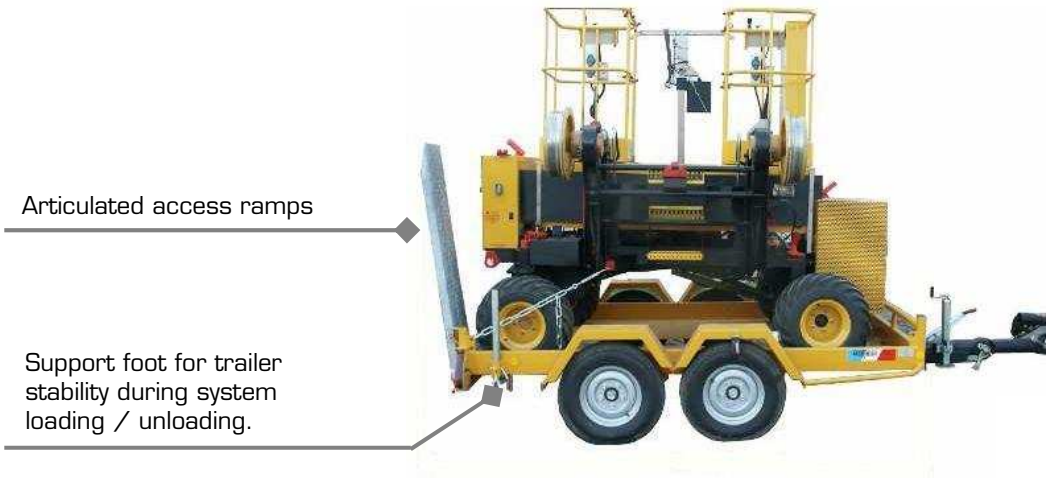


Equipotential mast in inactive position

3.7. The trailer

The system is designed to be easily and quickly transported by road from the workshop up to the site.

A trailer with gross vehicle weight rating of 3,5 T is proposed as an option. Specially chosen to make easier to the system to go on or down, the whole equipment widely fit inside road vehicle gauges. The fastening hook can be adjusted in height to best balance with the type of the towing vehicle.



3.8. Off-track working option

To permit to achieve electrification works when the track is not yet laid or to punctually lift personal out of a track, the X3 can be equipped with stabilizers to be mounted on the rail wheel supports.

By lowering the rail wheels, just as when setting on track, the system will automatically be stabilized. In case of ground flatness irregularities, each mechanical cylinder can be adjusted in

stroke to insure enough stability. When working directly on ballasted ground, larger feet can be clipped at the cylinder ends.

For maximum safety, each mechanical cylinder will be equipped with load sensor which will authorize or not the lifting motion of the platform.

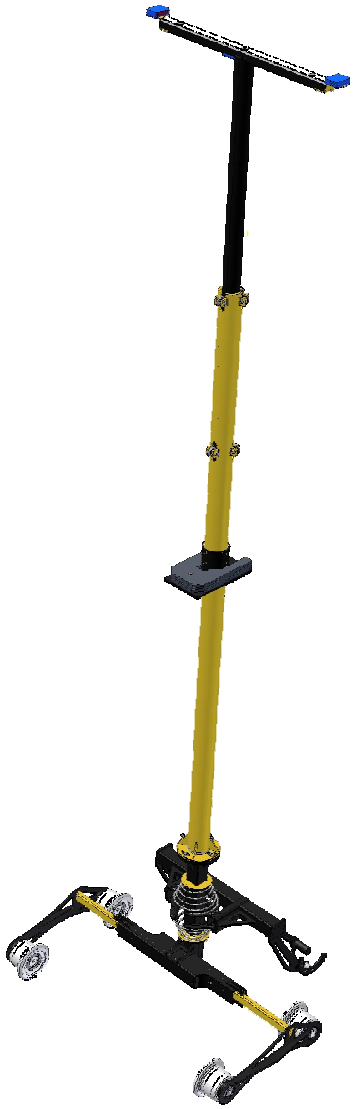
3.9. HDU - Catenary measuring option

During and after the integration of the catenary line, it is important to be able to precisely control the height and the stagger of the overhead contact line.

The HDU device is the perfect tool to be easily fastened to the X3 machine or even to other railway machine. Entirely designed by UNAC, this option not only measures and shows the stagger and height in real-time, but it also stores it and is capable to display the track distance information (km position).

Indeed, an encoder sensor is wheel-mounted and permits to inform about the covered distance. This information is particularly useful for quality management system and also during the catenary integration works as it can give the distance from the posts to precisely inform the operator where to mount the pendulums.

Made with only one roller-guided telescopic arm to avoid plays, the HDU measuring device will be a good and reliable measuring option for the X3.



3.10. The X3-t – W3 with cab

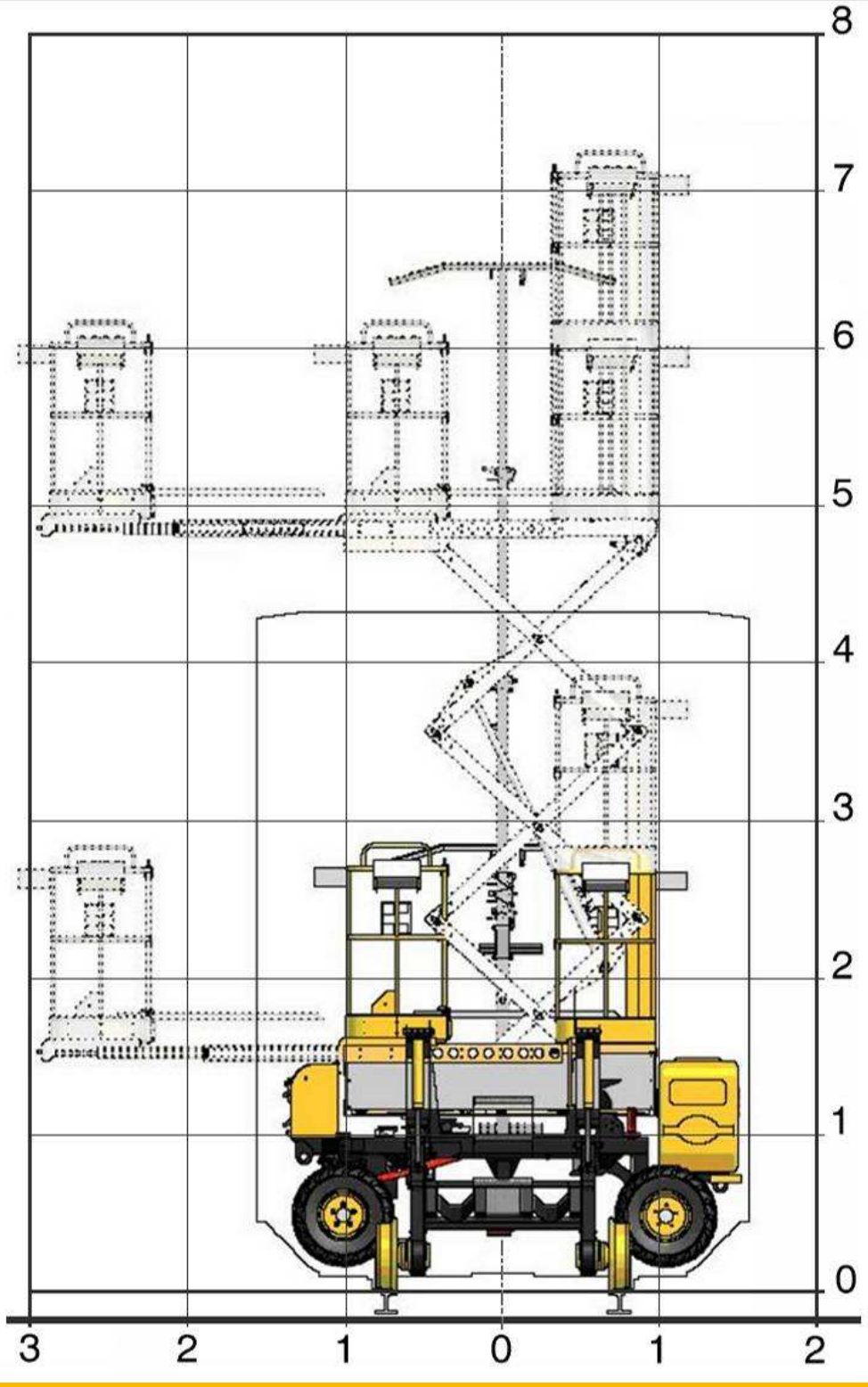
Thanks to its actual and efficient all-road character, the X3 does also exist in cab option in order to allow proper site inspection, catenary measuring and controls, or site surveillance (watching).

3.11. The X3-g – X3 with crane

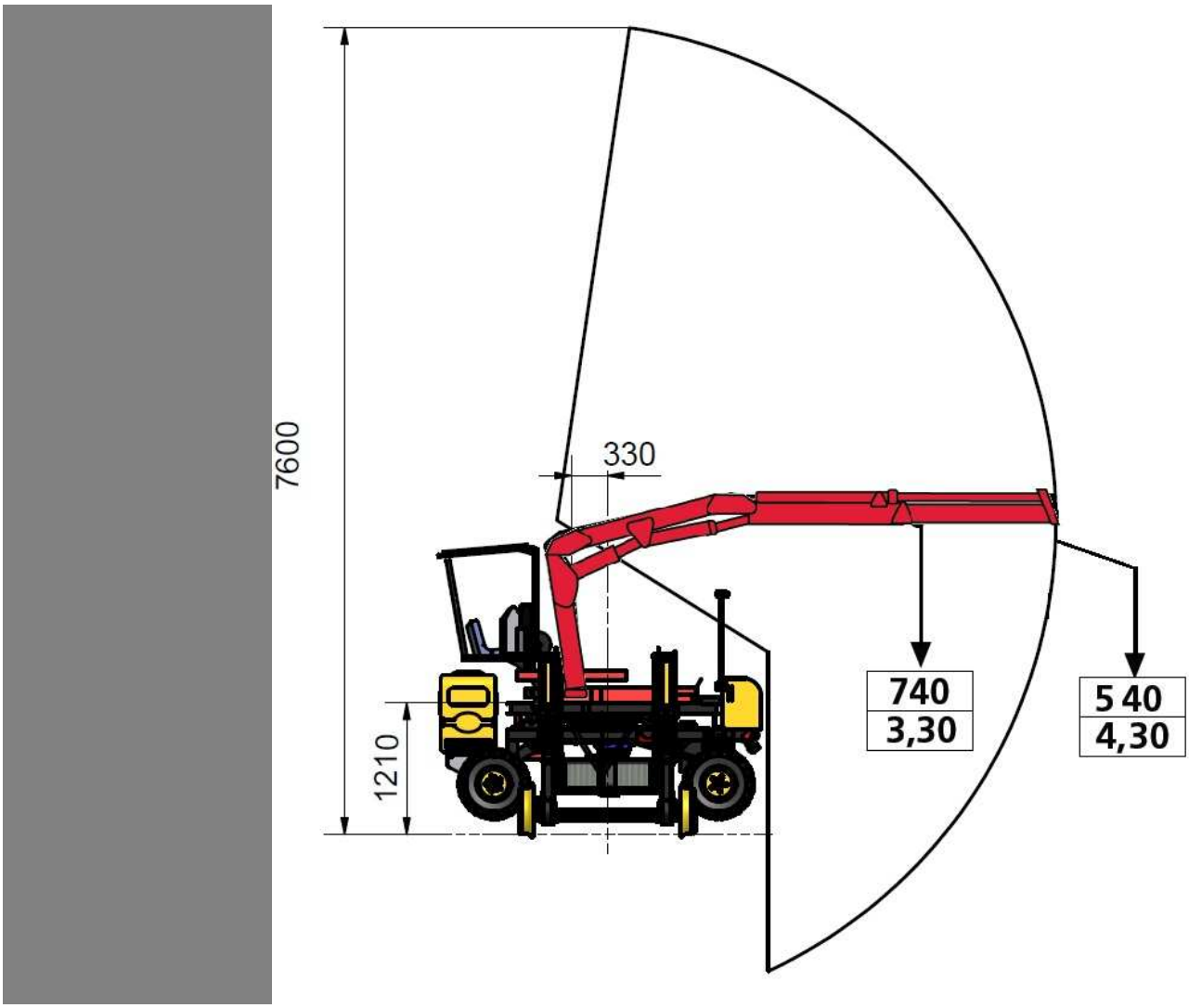
It all-terrain capability is also liked for on-track handling of loads.
The X3 with crane option is there a very versatile and independent system, able to access and to leave the track in a minimum of time.

4. DIAGRAMS AND DIMENSIONS

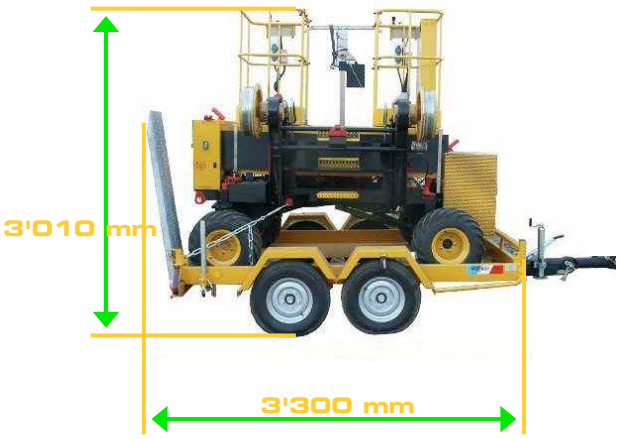
4.1. Working diagram – X3



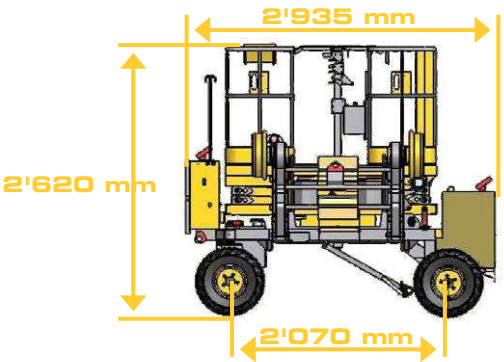
4.2. Working diagram – X3-g

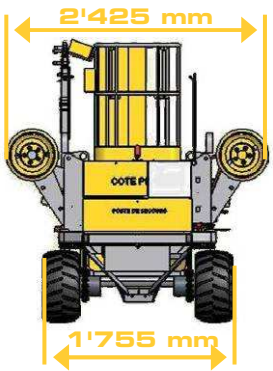


4.3. Main dimensions

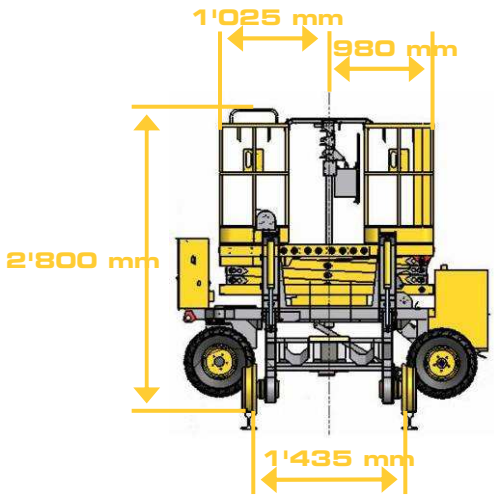


With the trailer





On road



On rail track

All functions, characteristics and other specifications of the product written in this document can be changed without prior notice.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